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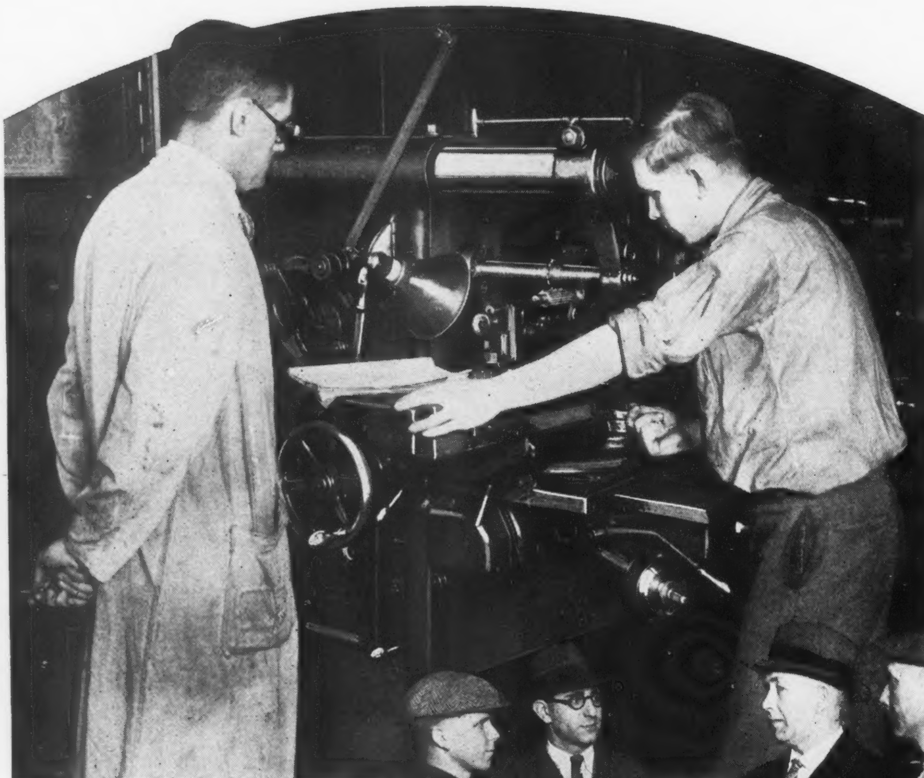


The new apprentice first works in the machine shop classes of the city's vocational school. In this way it is possible to determine his interest in the work and whether he is adapted for it. He also obtains his first shop training under instructors who give their entire time to the teaching of machine shop practice

When the boy is transferred from the vocational school to the actual shop where he is to serve his apprenticeship, he is first introduced to the general foreman who has charge of all apprentices and to the foreman in whose department he is to begin his work. The necessary instruction in the operation of machines is given by each foreman to the apprentices that are in his charge

the apprentice training seriously, that the department has been set up, and that the work has been carried on for a number of years.

Interviewing the Apprentice

A young man enters the office of the apprentice supervisor. He wants to become a machinist or toolmaker. How he has become interested is a story in itself, which has already been touched upon in previous articles. (See MACHINERY, December, 1927, "Results of Milwaukee Apprenticeship Plan"; and April, 1928, "The Modern Trend of Apprentice Training.") Although there are exceptions, the young man is likely to be timid and ill at ease, and the first duty of the supervisor is to treat him in such a manner that he is made to feel at home. His confidence must be won.

The first interview is brief. The supervisor questions the boy as to his age, education, previous employment, reasons why it was discontinued, and obtains his address. He inquires particularly why the applicant wishes to become a machinist, and finds out what he knows about the work. It is important that the supervisor should question the applicant directly and not merely give him an application blank to fill out, because the boy's language and manner in answering the questions

Every apprentice attends a vocational school class one-half day each week for instruction in subjects pertaining to machine shop work. Here he receives individual attention, and may advance just as rapidly as his ability will permit

to some extent indicate his character and temperament. The interviewer rates the applicant by the letters A, B, C, and D. This rating is not final, but determines the order in which the applicants are called in, as vacancies occur. The information obtained is dated and filed, and the applicant is told that he will be called as soon as an opening can be found.

When vacancies occur, applicants with A ratings are called first. If the list of A men becomes exhausted, the B applicants are called, and so on. Sons and near relatives of employes are given preference, because experience has proved that the older employe has a favorable influence on the work of the apprentice, and a stronger organization can be built up in this way. As a general rule, a number of applicants have to be notified before an opening is filled, because many of them become employed after entering their application.

When the applicant reports in response to this call, a record card is made out for him, giving the usual information regarding employes and, in addition, his classification, that is, whether he is a regular four-year apprentice (grammar school grad-

Instruction in matters pertaining to the industry and the employer, the product and policies of the shop, and the relations between apprentices and their fellow workers is given by brief informal weekly talks by the supervisor of apprentices

uate), a three-year apprentice (high school graduate), or a two-year apprentice (college graduate). A record is also made of any qualifications he may have in athletics or accomplishments for entertainment.

Trying Out the Applicant in the Vocational School

The new apprentice is not put to work in the company's machine shop, but is placed on the payroll and sent as a full-time student to the machine shop classes of the Milwaukee Vocational School. In this way, his interest in the work and his adaptability for it are determined. How long he remains in the school shop depends upon the time required by the instructors to reach a decision about him, and the openings in the company's shop. A number of boys are always kept at the school so that one or two who have shown themselves suitable for the work can be taken into the shop on brief notice.

In the school, the boy is taught the fundamental shop operations and the use of the simpler tools. Meanwhile, the instructors observe his progress and attitude, and either recommend that he be taken into the shop or suggest that he try a different occupation.

Is It Profitable to Pay the Boys for Going to School?

It may appear expensive to maintain a number of boys at school on non-productive work, but as a rule they do not remain there more than a few weeks, or two or three months at the most. Utterly inexperienced as they are, they would be of little value as producers if they spent those first weeks or months in the plant. They would be more of a burden than a help. They would also take up more of the foreman's time than half a dozen older apprentices. In the school shop, they are under the charge of professional teachers who make it their business to handle boys in the first stages of their development. Furthermore, the apprentice is selected by the best possible kind of test—the test of actual work.

> The selection of the right kind of boy to start in the apprentice training course requires judgment and tact. When the boy enters the office of the apprentice supervisor and says that he wants to become a machinist or toolmaker, he is likely to be timid and ill at ease. The first duty of the supervisor is to treat him in such a manner that he is made to feel at home. His confidence must be won. Without this it is impossible to find out with sufficient accuracy the facts upon which the supervisor can base his judgment as to the fitness of the boy for the machinist's trade and his chance of success.

The Apprentice Goes to Work in the Shop

The apprentice is called from the school in the afternoon of the day before he is to start in the plant. He is introduced to the general foreman who has charge of all apprentices and to the foreman in whose department he is to work. He is told what tools he will need, and is given an opportunity to buy them at reduced prices through the company's purchasing department. A locker is assigned to him, he is given tool checks, the use of which is explained to him, and he is instructed in the purpose and use of the time clocks.

The work of the apprentice progresses in a general way from the simpler operations to the more difficult ones, but nothing is specified regarding the operations on which the boy is to begin or their succession during the training course. The general foreman is free to give him such work as needs to be done and to exercise his judgment in the choice of the work, according to the ability and experience of the apprentice. However, each boy makes a daily record of the operations and machines upon which he has worked and the number of hours spent on each. These records are totalled in the office of the apprentice department. No boy is permitted to work on any machine or operation after he has completed the full number of hours assigned to that operation or machine in the apprentice plan. In the four years of regular apprenticeship, his contract calls for the completion of the following schedule of hours: Engine lathe, 2400; milling machine, 800; boring mill, 1200; planer, 1200; shaper, 600; drill press, 600; erecting, 600. This is a total of 7400 hours. The four-year apprenticeship consists of 9760 hours, leaving 2360 hours unassigned.

A high school graduate apprentice completes the following hours: Engine lathe, 2000; milling machine, 600; boring mill, 1000; planer, 1000; shaper, 500; drill press, 500; erecting, 500. This amounts to 6100 hours and leaves 1220 hours unassigned out of a total of 7320 hours in the course. The unassigned hours are devoted to additional work upon one or more of the machines mentioned in the schedule, depending upon the ability and inclination of the apprentice, or to work in a supplementary schedule for both regular and high school apprentices, including turret lathe, boring bar, screw machine, grinding, tool-room, and special work.

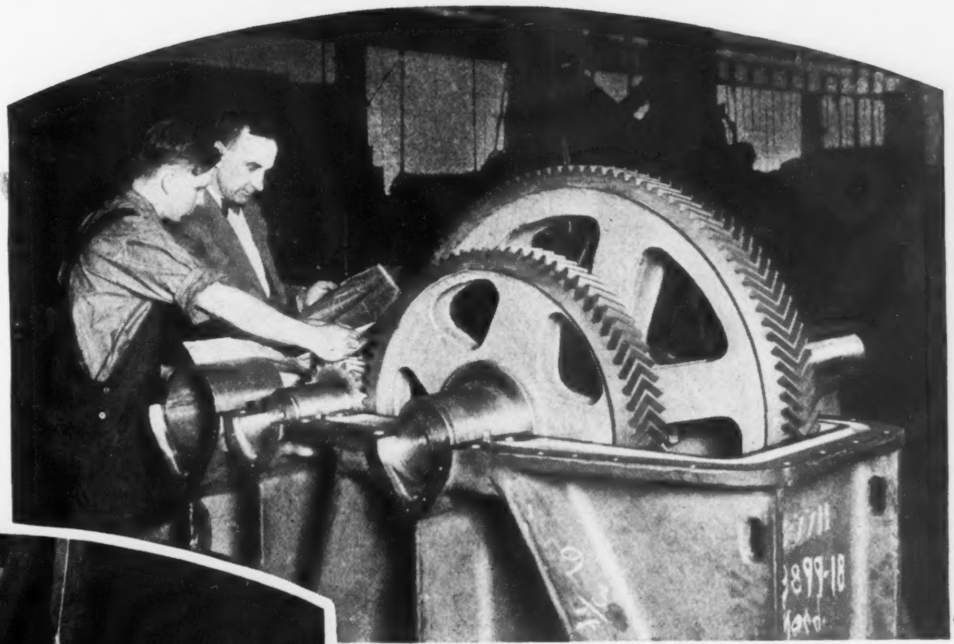
The general foreman maintains close contact with the apprentice department, checking the number of hours completed on all operations, so that no apprentice is employed on any work beyond the number of hours required by the contract until he has received the regular all-around training specified. Of course, the number of hours can be only approximately adhered to. It is obviously impossible to transfer an apprentice to different work the very first hour after he has completed the required time on one type of machine, and it is of no consequence as far as his training is concerned.

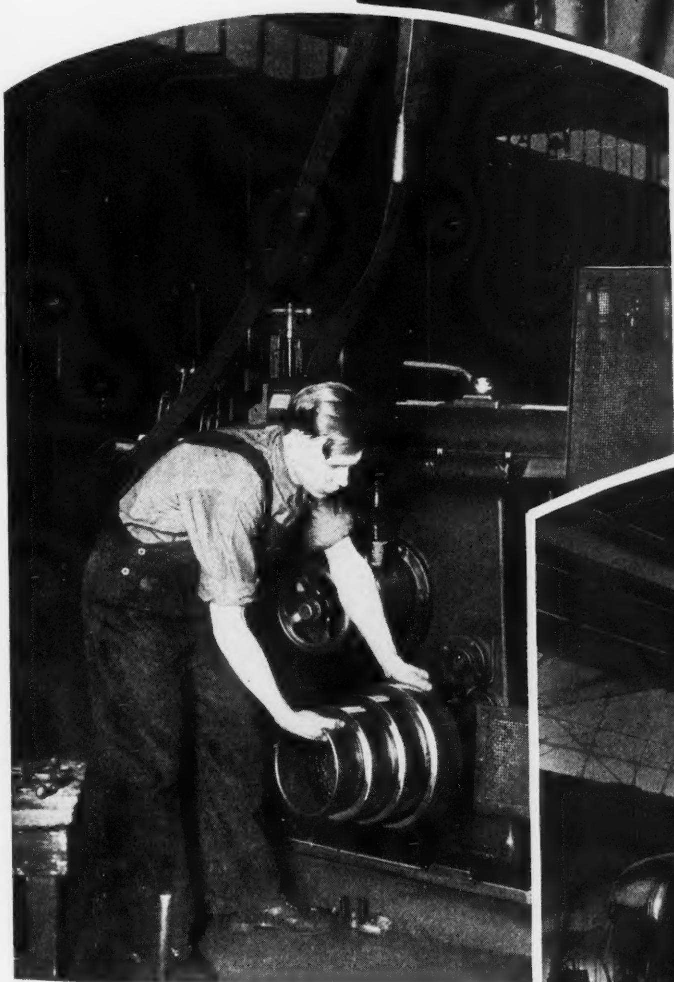
The Classroom Instruction is an Important Item in Modern Apprentice Training

A good machinist must have some theoretical, as well as practical, training. The practical side is taught in the shop; the theoretical side is best taught in a school. The apprenticeship law of Wisconsin requires every apprentice to attend a vocational school one-half day per week. Hence, it was easy to make arrangements with the Milwaukee Vocational School for the complete theoretical instruction of the apprentices.

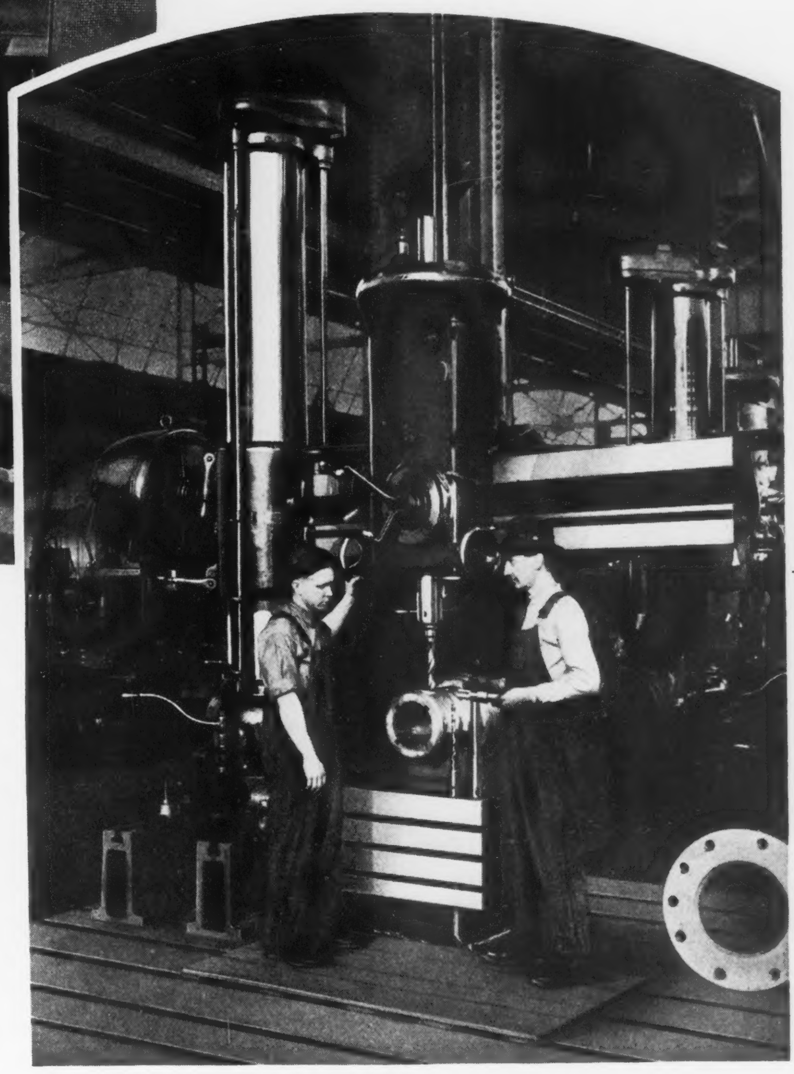
The school program provides for adequate theoretical instruction. Since apprentices are taken on at all times, regular classes are not formed and lecture work is not practical. Individual instruction is the usual method. The courses are arranged

A good toolmaker or machinist must have some theoretical as well as practical training. The practical side is taught in the shop; the theoretical side is best taught in a school. The foreman can impart a great deal of useful knowledge to the apprentices, and they are encouraged to ask questions of their foremen concerning matters pertaining to their work





A flexible system of training has proved to be the best in developing all-around machinists. There is nothing specified regarding the operations on which the apprentice is to begin or their succession during the training course. In addition to production operations, the apprentices are often employed temporarily on emergency repairs to machinery



The general foreman is free to give the apprentice whatever work is to be done in the shop and to exercise his judgment in the choice of the work, according to the ability and experience of the apprentice. During the entire course, however, each apprentice will have an opportunity to work a specified number of hours on each type of machine, so that he will obtain a complete all-around training. Apprentices who display outstanding ability are given responsibility in the performance of unusual work when available

in separate units or lesson sheets, and each apprentice advances as rapidly as he can complete and understand the work given to him. The instructor gives to each student whatever assistance he needs. Elementary and advanced students of the same subject work together in the same room. The courses are so arranged that the slower workers are able to learn that which is essential to their trade, while the more gifted students learn much that the exceptional machinist can frequently apply in his work. Special courses are provided for high school graduates and even for college men.

The vocational school cannot instruct the apprentices in matters relating to the employer, his products and policies, and the relations between the apprentices and their fellow workers in the shop. These matters are covered by talks given by the apprentice supervisors. The boys are divided into five groups, and each group listens to a talk once a week. A new subject is taken up each week. The regular series of talks is completed in fifteen months, and is thus repeated three times in the course of an ordinary apprenticeship. This is not too often. The apprentices forget much in fifteen months and repetition does not do any harm.

The following are typical subjects for these weekly talks: Working with the foreman, regularity and promptness, waste prevention, civic duties, your employer, and the importance of clerical work. Moreover, these meetings provide an opportunity for announcements and for such correction and encouragement as may be necessary.

The product of this complete training process is a full-fledged machinist, who is interested in the mechanical industry and who has learned to work diligently and efficiently, with both hand and brain

Interruption of Work when the Boys Attend School

A question that has often been raised in connection with the Milwaukee plan of apprentice training relates to the interruption in the regular production work when the boy has to attend school one afternoon every week. This difficulty has been satisfactorily overcome. In order to prevent constant interruption of work, causing idle machinery on account of school attendance, a system of relief operators has been devised. Two apprentices attend school each morning and two attend each afternoon during the week. Two of the oldest apprentices who have had extensive all-around experience serve as continuous substitutes, and each half day they operate machines in place of the two apprentices who are at school.

It is evident that the number of apprentices can never be so exact that they will fit completely into such a schedule, and the younger apprentices are not included in this plan; but as they are assigned to less important work on less highly productive machines, this is not a serious disadvantage.

The Training Given by the Vocational School

In Milwaukee, the plants training apprentices have had excellent cooperation from the city's vocational school, even to the extent that the school provides special coaching for those apprentices whose work in the shop indicates that they need instruction in one subject or another. The work covered in the vocational school in the course for machinist apprentices includes weights and measures, elementary science—matter, heat and magnetism; properties of materials, simple machines and mechanisms; shop mathematics, up to and including trigonometry; special problems in bench work, planing, lathe work, and other machine shop operations; safety, citizenship, hygiene, and English.

The product of this complete method of training is a young man who is interested in the mechanical industry and who has learned how to work diligently and effectively, with hand and brain. He has had four years of all-around machine shop experience and has a better knowledge of the machinist's trade than could be acquired in the same number of years by any other method. He is not an expert in any one line of machine work, nor is he expected to be. He has built a broad foundation, which is an excellent preparation for further development and for promotion later on. Very often he becomes particularly interested in one particular line of machine work during the course of his apprenticeship, and is anxious to become a specialist in that particular line. Nevertheless, he remains a versatile man who can be given work anywhere around the shop. He does not, as yet, rank with the best mechanics, but the probabilities are that he will some day. All in all, he has made himself valuable to his employer and has created promising prospects for himself.

[In an article to be published in August MACHINERY, Mr. Freund will give attention to some of the details of the apprentice training that have been merely touched upon in a general way in this article.—EDITOR]

The Value of Modern Plating Methods

Modern Engineering Methods are Now Applied by the Electroplater to Protect Metals Against Corrosion and Obtain Decorative Effects

By FREEMAN C. DUSTON

WITHIN the last few years remarkable improvements have been made in the methods of handling electroplating work. Great improvements have also been made in the physical properties of steel and non-ferrous metals; but metals having the required strength for a given purpose often are subject to rapid corrosion. On the other hand, a metal that will resist corrosion satisfactorily may not have the necessary strength or may be too expensive. By means of electroplating, a metal possessing great strength can be given a thin protective coating of another metal that resists corrosion satisfactorily.

In addition to great strength and corrosion resistance, a metal product is often required to have a pleasing appearance. Fortunately, the metals that are desirable for their decorative effect generally have the best corrosion-resisting qualities, but as a rule they are the most expensive. The cost of the metal itself, however, is of relatively little importance when it is applied to another metal by electroplating, as the electro-deposited coating need be only a few thousandths of an inch in thickness, at the most. As a matter of fact, in many cases, the difference in the total cost between the deposition of gold, silver or nickel is difficult to estimate.

Plating as a Sales-promoting Factor

In the sale of merchandise, especially metal products, it is the finish that attracts the eye and stimulates sales. The mirror-like chromium plating on the radiator, lamps, and trimmings of an automobile, for example, plays an important part in promoting sales, but of equal importance is the permanence of this finish and the fact that it retains its luster without constant polishing and attention. The latter feature goes a long way toward keeping the customer satisfied, and is a factor that cannot be overlooked by any manufacturer in these days of keen competition.

Thus, we have two important reasons for electroplating, namely, to protect a metal against corrosion and to improve its appearance. In some cases, where both these qualities are of paramount importance, they can be satisfactorily and economically secured by applying two or more different metals, that is, by applying a second plating of a different metal over the first plating and, in some instances, a third metal over the second. For example, the pressed-steel shell of an automobile radiator may have a plating of copper, and over this a coating of nickel, and over the nickel a very thin coating or "flash" of chromium.

Why Three Different Plating Metals are Sometimes Applied

Some of the more important reasons for employing three separate metal coatings in the case of the automobile radiator shell will be stated briefly. A copper coating is first applied directly to the steel shell base because copper has the property of giving a more uniform coating than nickel or chromium in equivalent thicknesses. Where, for the purpose of reducing the total cost, the steel shell itself is not polished to the highest possible lustre, a frequent practice is to apply a relatively thick coating of copper, which is then buffed to a high lustre before the application of the coats of nickel and chromium.

Nickel is then applied in order to cover up the reddish color of the copper coating, eliminate porosity in the copper coating, and produce a hard, smooth, adherent base for the final coating of chromium. Finally, over the base of copper and nickel is applied the electro-deposited flash of chromium, which serves as a hard, durable, non-tarnishing metallic lacquer over the nickel. This method of finishing radiator shells is only one of the many methods successfully employed by automobile manufacturers, and is described here for the purpose of drawing attention to the important characteristics of a three-layer electro-deposited finish.

Expensive Appearance of Plating does not Suggest its Low Cost

Because properly applied plating looks expensive, many manufacturers have been under the impression that it is too costly for their products. This may have been the case some years ago, but modern equipment has reduced the cost of plating to a point where it can be economically applied to practically any metal product, and there are hundreds of products on the market today that would be practically valueless without an electroplated finish.

A little reflection on the low prices at which gold-plated safety razors and similar products are obtainable should convince the most skeptical manufacturer that the cost of plating small articles cannot be very high. As a matter of fact, the plating costs for hundreds of metal products used in everyday life is but a small percentage of their selling price. This has been made possible by the development of production plating equipment and by improved methods and materials.

Lack of Standardization in Plating Methods

Considerable difference of opinion regarding the relative merits of different plating metals and methods exists among manufacturers of the same or similar products. This is probably due largely to the fact that manufacturers experienced in applying one kind of plating have attempted to employ similar methods and equipment in applying a different metal, not realizing that a different procedure may be necessary for the best results.

Manufacturers of similar products have developed their plating methods along different or individual lines and, consequently, there is a general lack of standardization in plating practice. Under these conditions, it is not surprising that manufacturers who decide to adopt plating as a finish for their products often find it difficult to determine what kind of metal plating to use and what equipment is required to handle their work economically.

The demands of the automotive industry for more effective means of preventing metal parts from rusting and for a more nearly perfect plating for trimmings have been responsible for a tremendous amount of research work within the last few years. The Bureau of Standards has carried on extensive tests and experiments, and as a result, much new and valuable information on electroplating has been made available in bulletins prepared by this department of the Government.

Development of Production Plating Equipment

In order to make possible the practical application of the most effective plating metals on a production basis, the engineers of the Hanson-Van Winkle-Munning Co., manufacturer of electroplating and polishing equipment and supplies, Matawan, N. J., have developed and perfected equipment of various types, and have carefully studied the complex electrochemical and metallurgical problems involved. As a result, this company has been able to develop its facilities to a point where it can analyze a plating job and quote prices on a complete installation for handling the work at a definite cost per piece just as accurately as a machine tool builder can quote prices on equipment for handling a certain machining job at a given production rate or cost per piece.

The equipment required for a plating job may consist of a single unit in which the article to be plated is fed in at one end and removed in the finished condition at the opposite end. The amount of equipment required, however, depends on the size and shape of the parts to be plated, the material from which the parts are made, the kind of plating to be applied, the degree of finish or polish required, and the condition of the surface of the metal to be plated.

In some cases, machines for polishing, buffing, and cleaning the work preparatory to plating may be required in addition to the machines in which the plating is actually done. The materials for polishing operations, cleaning baths, electroplating baths, and the metal anodes or metallic salts from which the metal plating is deposited must all be properly selected and prepared in order to insure satisfactory results.

The smoothness and rapidity with which work passes through the polishing, buffing, cleaning, and plating operations in a modern electroplating plant gives one the impression that the whole procedure is comparatively simple, as in fact it is, when everything is properly arranged in accordance with known engineering facts; but there is a vast amount of labor back of this accomplishment.

A seemingly slight change in the regular plating process or in the operating conditions often produces a marked change in the results obtained. On the other hand, wide modifications in the regular procedure can sometimes be made to advantage or to meet certain conditions. For these reasons, manufacturers who use electroplating equipment and engineers engaged in the development of equipment and materials should be mutually benefitted by a freer discussion of the problems encountered.

* * *

Weighing Methods That Cut Costs

The weighing of materials and the counting of parts by weighing them with so-called "counting scales" are important items in the operation of many machine shops. A number of types of scales adapted for use in industrial plants will be illustrated and described in an article in August MACHINERY. Attention will also be called to numerous applications of weighing scales in machine shops and shipping departments. This article will give information as to the most practical types of scales to use for varying conditions. Special mention will be made of counting scales that show automatically the number of pieces of uniform weight that are placed on the scale platform. Among other interesting applications referred to are the weighing of objects that are suspended from cranes and the weighing of parts to insure proper balancing of machinery and mechanical devices.

TUNGSTEN CARBIDE TOOLS IN AUTOMATICS

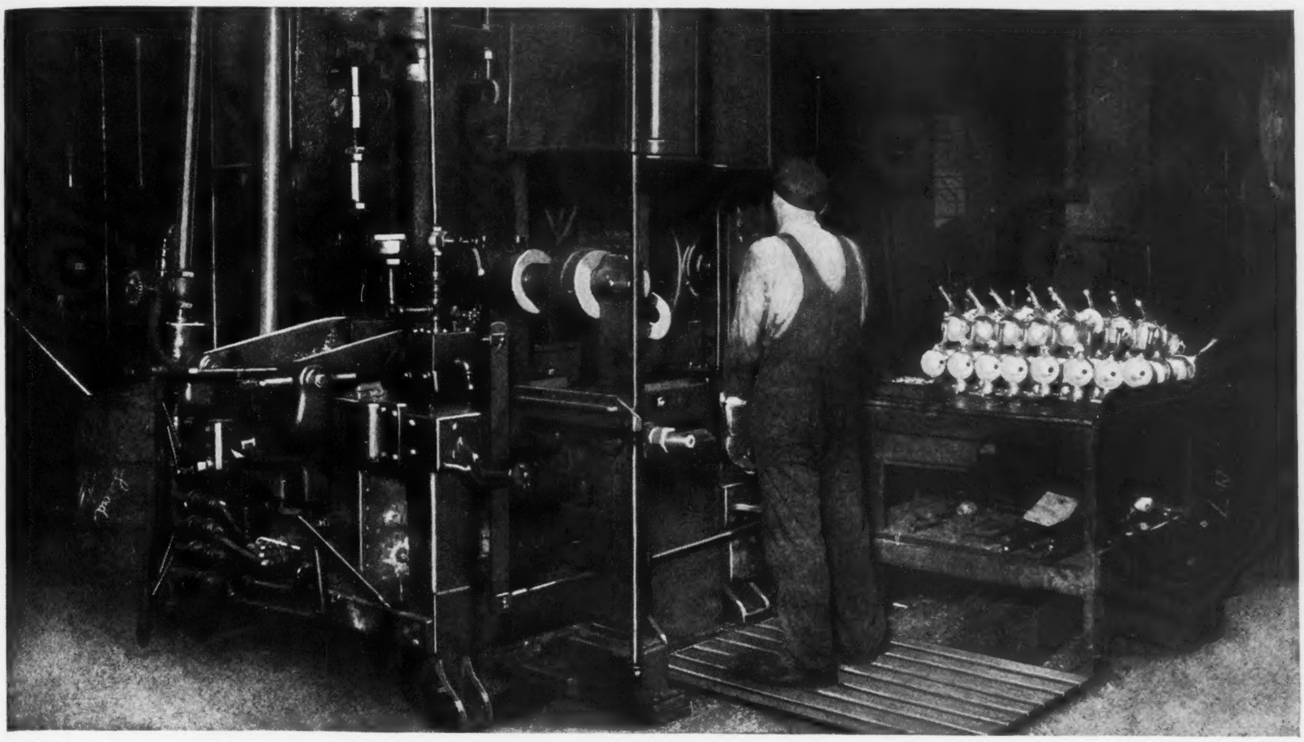
In a report made by the Special Research Committee on Cutting of Metals before the Rochester Meeting of the American Society of Mechanical Engineers, two examples were mentioned of the use of cemented tungsten carbide tools (such as Carboloy, Widia, etc.) in automatic machines, completely tooled and placed in operation on a production basis.

To quote the report: "A large valve company has tooled an automatic chucking machine with tungsten carbide tools, replacing high-speed steel tools for machining a bronze valve disk. The average life of the high-speed steel tools was 600 to 800 pieces per grind, while that of the carbide roughing tools was in the neighborhood of 27,000, the speeds, feeds, etc., being identical in each case. Incidentally, the high-speed steel used was the best obtainable. The part in question required a very good finish, and for that reason it was considered advisable to continue to use a finishing operation. The tungsten carbide finishing tools had produced about 28,000 parts at the time of our visit and were apparently as good as new.

"Another manufacturer replaced high-speed steel tools with tungsten carbide tools for machining a malleable iron part having brass inserts. This operation likewise was performed on an automatic machine with no changes except the substitution of tools. The best tool life obtainable with high-speed steel was from three to eight hours per grind. The first set of tungsten carbide tools ran for over six weeks before requiring regrinding."

* * *

According to *Automotive Industries*, a special mixture of gasoline and 20 to 35 per cent alcohol is used in Germany as a fuel for automobiles.



Die-Casting Dies of Recent Design

Examples Showing How the Ingenuity and Skill of Die Designers and Diemakers Have Helped Advance the Die-casting Art

By JOHN S. GULLBORG, President, The Alemite Die Casting & Mfg. Co.

DIE-CASTING concerns have found it necessary to produce dies of a multitude of designs to meet the demand of manufacturers of automobiles, washing machines, small electrical devices, typewriters, and other mechanisms requiring accurate interchangeable parts in quantity. Each casting presents a die problem which must be dealt with individually by the designing department and the tool-room. Die designing and diemaking, therefore, have played an important part in the rapid adoption of die-castings by the various industries.

With progress in die construction, it has been possible to cast parts of increasingly intricate shape. While the ideal die is simple in construction, it is the common practice of the company with which the author is connected to employ dies having as many as twenty-five or thirty cores for a single casting. Sliding cores may be pulled from either side or end of dies, or from overhead. Typical dies recently made will be described in this article.

Both Ordinary Machine Steel and Alloy Steel are Used for the Dies

Die-castings are made by the concern mentioned from alloys of four different base metals; aluminum, zinc, tin, and lead, respectively. Dies for producing castings from zinc, tin, or lead alloys are made from ordinary machine steel, since the highest melting point of these alloys is 780 degrees F. For aluminum castings, however, the dies are made from vanadium steel unless the castings are unusually complicated or more than 50,000 castings are produced per year. In such instances, the die parts are made of tungsten steel. Aluminum alloys melt at the comparatively high temperature of about 1150 degrees F., and it is for this reason that high-grade alloy steels must be used in building dies for casting aluminum parts.

In making the dies, impressions are often worked into solid blocks of steel weighing several hundred pounds each. When the castings are to be made of zinc, tin, or lead alloys, the dies can usually be made in sections that are fitted together in assembling. However, for aluminum castings, the die halves generally must be of one-piece construction in order to withstand the high casting temperatures. Special cutters are required for almost every die, and in making these tools, as much time is often consumed as in making the die cavity itself. Under such circumstances, weeks and sometimes months are taken to build a die for a part.

When the dies have been finish-machined, they are put through a careful heat-treatment. One set of dies may be used for producing anywhere from 10,000 to 200,000 castings before it need be scrapped, the output depending upon the construction, the material from which the die is made, and the casting alloy used. One ton of castings, on the average, is produced per set of dies in a nine-hour

day. A large battery of die-casting machines is installed in the Chicago plant of the company, the reservoir capacity of each machine being approximately 1500 pounds of molten metal.

Fig. 1. Removing a Casting from a Die Having Numerous Long Slender Cores

General Features of Die Construction

Since each die consists primarily of two parts, stationary and moving, there will always be a parting line on the casting. It is the practice to locate this parting line at the point that will permit easiest ejection of the casting from the die, at the same time keeping in mind the appearance of the joint on the finished part. Whenever it is practicable to do so, the parting line is located on an edge of the casting.

Hot metal is forced into the die at pressures up to 600 pounds per square inch, in making castings. This means that only a fraction of a second is consumed in filling the die cavity. For this reason, the gate must be so designed that the metal can flow freely, with the least possible friction. The gate is always located on the under side of the die.

It is also essential to vent dies in such a manner that the air can escape quickly with the onrush of the molten metal. For this purpose, wide, shallow grooves or vents are provided in the faces of the die halves. These grooves allow the air to escape at the proper speed and cause the metal to "freeze" as it attempts to enter the shallow passages, which effectively stops the flow of metal. The air vents are made from 0.003 to 0.005 inch deep and from 1 to 1 1/2 inches wide. They are usually placed on the face of the die member which contains the cavity.

Dies are generally so constructed as to make the casting adhere to the moving member when the die opens up, so that ample provision can be made for ejecting devices. Frequently, spring "push-outs" are arranged on the stationary die member to insure that the casting will stick to the moving part until the ejecting mechanism is operated. Ejecting pins provided on the moving die member are commonly arranged to begin functioning when this die member has been opened about 3 inches. The pins then become stationary and eject the casting as the moving die member continues to withdraw a short distance.

Draft need not be allowed on outside surfaces of die-castings, but on inside surfaces a draft of from 0.002 to 0.003 inch is allowed per inch of length—

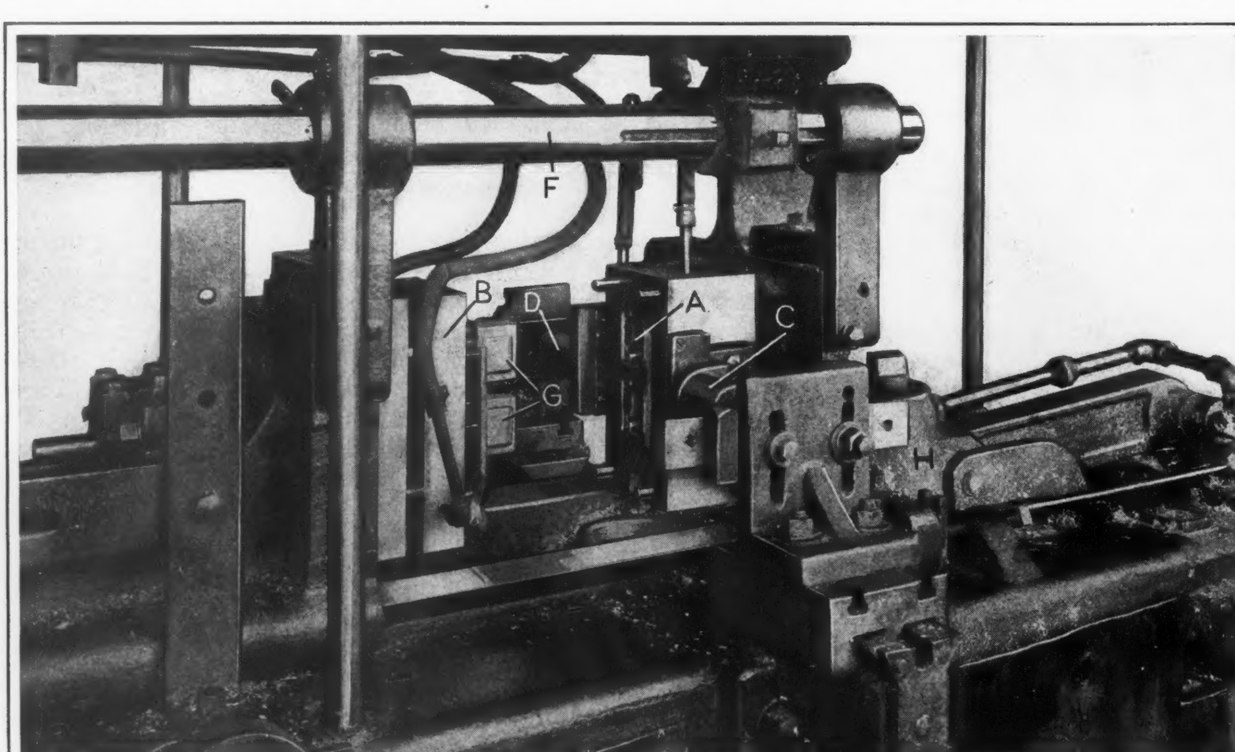


Fig. 2. Die-casting Machine Equipped with a Die Having Cores Pulled from Both Sides

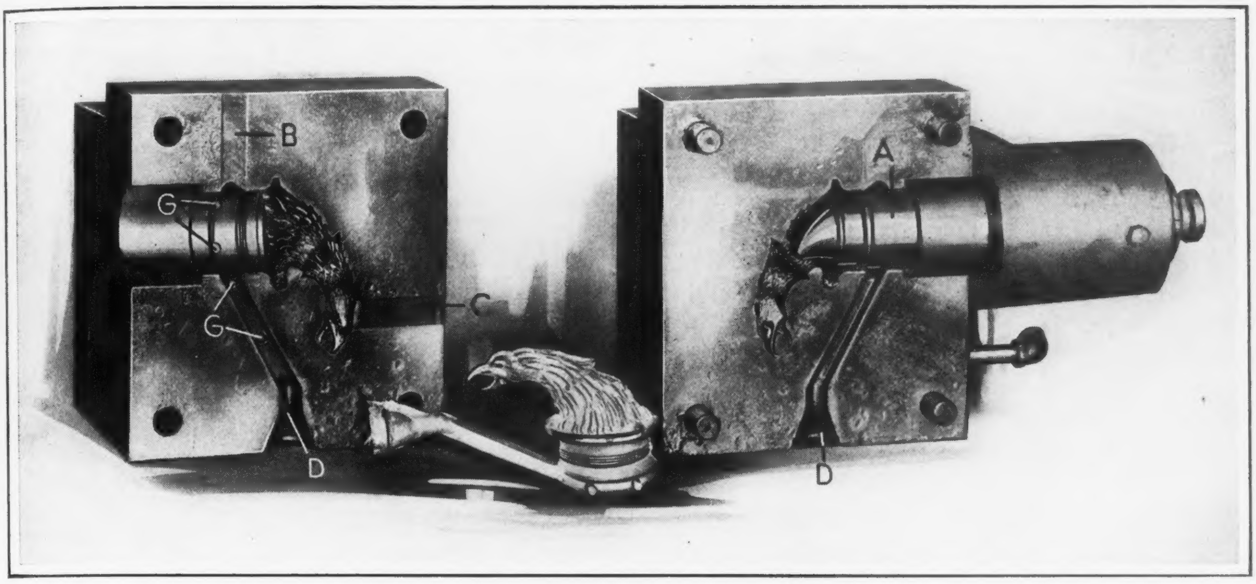


Fig. 3. Typical Die Employed for the Production of Artistic Radiator Caps for Automobiles

just enough to free the cores readily. On large cores a draft of 0.005 inch is sometimes allowed per lineal inch.

Cooling of dies is arranged for by circulating water through each die half. A chemical is brushed over the die faces in casting operations so as to prevent too rapid cooling of the metal as it strikes the die surfaces. This chemical forms an iron oxide that counteracts the chilling action of the cold die members.

Typical Die Constructions

In Fig. 1 is shown a die which consists primarily of a stationary member *A* and a moving member *B*. The work is shown at *C*. It will be seen that the stationary member is provided with a series of long, slender core-pins which produce corresponding holes in the casting.

Fig. 2 shows a more complicated die construction, for, in addition to the stationary member *A* and the moving member *B*, core mechanisms are arranged on two sides of the die, as indicated at *C* and *D*. These mechanisms automatically place various sliding cores in position ready for the casting operation, after the moving die member has advanced into position against the face of the stationary die. The mechanisms withdraw the cores after the casting has been made and before the moving die member opens up. The core-pulling mechanisms are operated through the swiveling of shafts which extend along the front and rear of the machine. These shafts are connected by means of cranks to the slides on which the cores are mounted. The cores may be operated vertically through motion imparted by shaft *F*.

Two small castings *G* are produced simultaneously with this die equipment. The stationary member of the die is mounted, according to the standard practice, on a plate attached solidly to the machine bed, while the movable member is secured to a ram that slides on dovetail ways of the bed, positioned on each side of the reservoir which contains the molten metal. The metal is forced into the gate of the die after the die has been closed, and the gooseneck *H* is swiveled to bring the nozzle at its forward end against the die gate.

Die for Radiator Cap of Ornamental Design

The die-casting process lends itself especially well to the production of many metal objects of

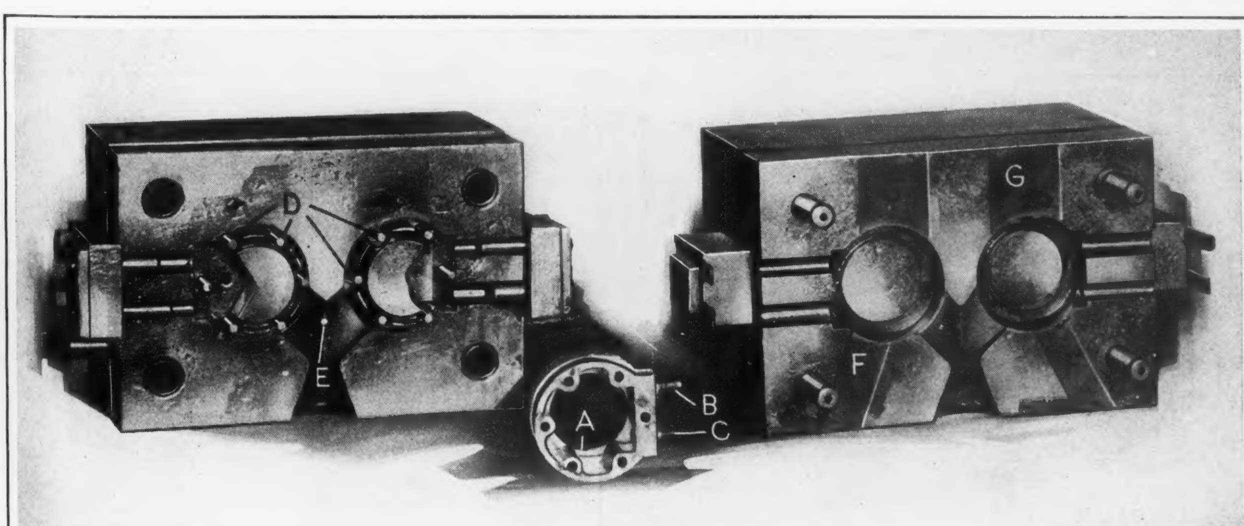


Fig. 4. Construction of Die Used in Simultaneously Casting Two Parts with Threaded Brass Inserts

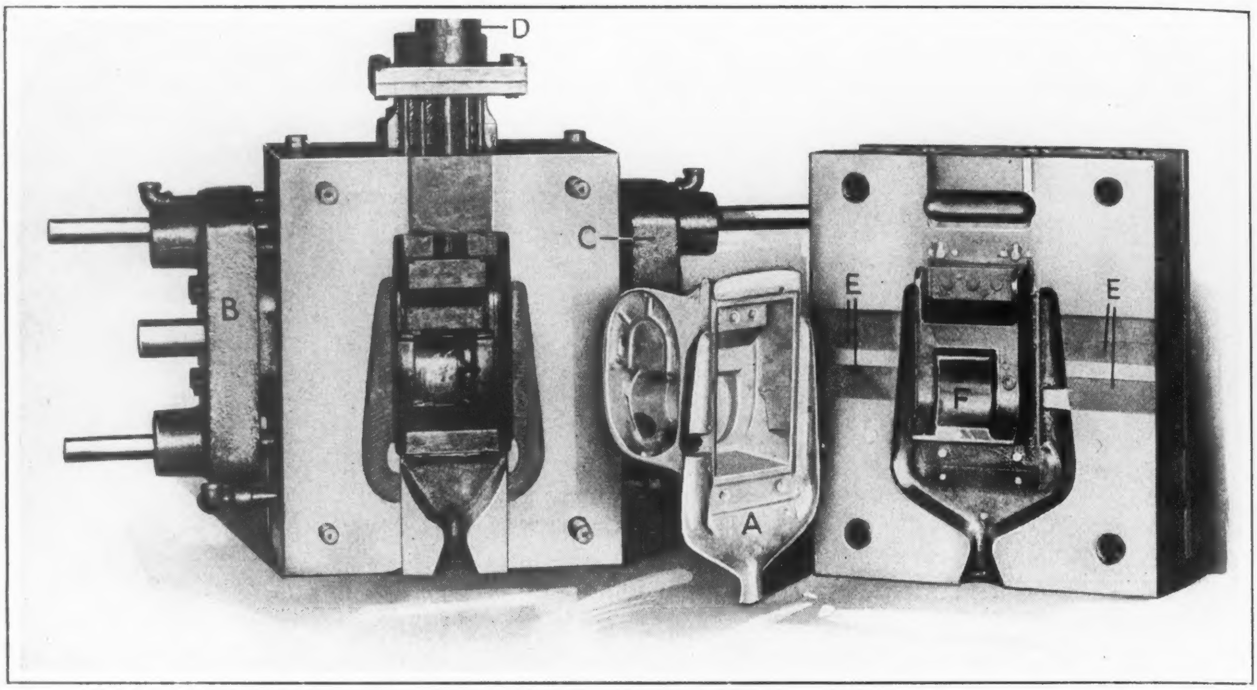


Fig. 5. Complicated Die for a Comparatively Large Part Having Several Compartments with Unusually Thin Walls between them

artistic design, such as radiator caps supplied on automobiles. Heads of birds, for instance, can be produced so that the various details of the feathers are very distinct. Fig. 3 shows a die employed for casting a cap having the head of an eagle, the stationary member being shown at the right and the moving member at the left. Only one core is required, as shown at *A*. It is operated from one side of the die and is used to form the cavity on the inside of the casting.

A unique feature of the casting formed with this die is that the bill of the eagle is reinforced with a small brass forging. This forging is placed by hand on the shoulder of the stationary die that is formed by the open mouth of the bird.

External threads are cast on this part. Vents to allow the escape of air may be seen at *B* and *C* of the moving die member, and a generous gate is seen at *D* on both members. Four holes in the moving member slip over pilot-pins on the stationary part to insure accurate registration of the two die halves for each operation. Holes through which the ejector-pins operate may be seen at *G*. The gate metal and flash left on this casting are readily removed by the use of band saws and disk grinding machines. The casting is made of a lead-base alloy.

Die for Part Having Two Inserts

Inserts of brass, steel, and other metals can be cast in parts for a variety of purposes. The inserts may be of any metal that has as high a melting point as the metal being cast. Sometimes die-cast pieces are used as inserts. In Fig. 4 are shown the die members used in producing part *A*, which is cast with two threaded plugs in place, as seen at *B* and *C*. The die is of unusually simple construction, with a parting line running along the middle of the part, and casts two pieces simultaneously. The inserts are placed in position on the face of the stationary die member when the die is open. Shoulders on the inserts guard against metal being cast on the threads.

Six holes are produced around each casting by the use of core-pins such as seen at *D*. Ejector-pins are visible beside each of these cores and at *E*. Air vents may be seen at *F* and *G* on the stationary

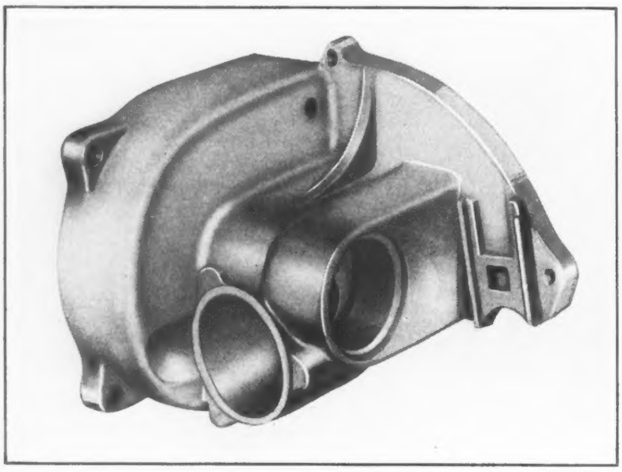


Fig. 6. Front Housing for a Portable Electric Saw which is Produced in the Die Shown in Fig. 8

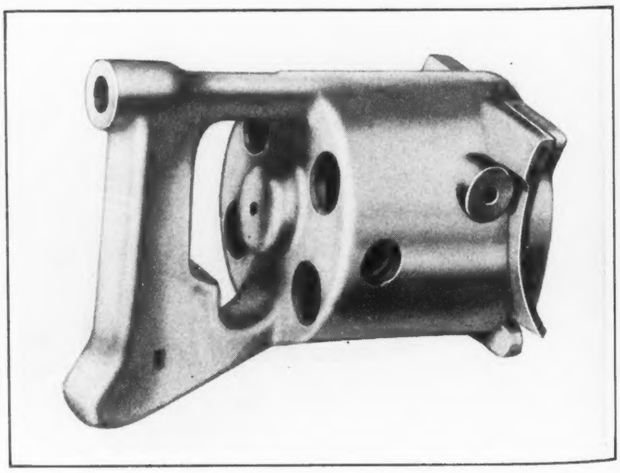


Fig. 7. Typical Motor Housing for Portable Electric Tools, Produced in Die Shown in Fig. 9

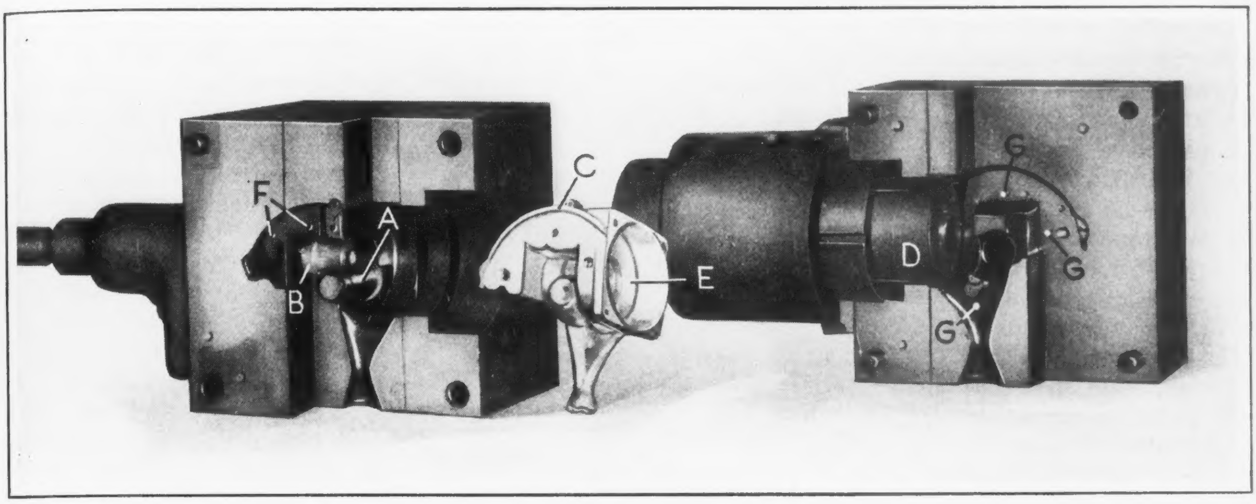


Fig. 8. Die Having Two Interlocking Cores which Produce Shaft Bores at Right Angles to Each Other

member. Unusual savings have been obtained by die-casting this part, as the drilling of nine holes is eliminated, as well as two threading operations, a turning operation, facing of the two sides, and machining of the outside contour.

Inserts are generally made with a circular groove close to the end that is held in the metal, and this end is knurled. Thus when the molten metal fills the groove, it securely locks the insert in place and by filling the knurling, it prevents the insert from turning. Inserts can also be made with lugs that prevent them from being pulled out of the die-casting or turned. The casting shown in Fig. 4 is made of a zinc-base alloy.

Many dies are built for producing eight or ten parts simultaneously, with or without inserts. For instance, various ornamental handles, such as are used on automobile doors, are cast eight at a time with steel-shank inserts.

Die with Unusually Narrow Gate

Fig. 5 shows a rather complex die employed for casting the aluminum housing shown at *A*, which has a number of compartments separated by unusually thin walls. This casting is approximately 8 1/2 inches long by 4 inches wide by 6 3/8 inches deep, and some of the walls are only 1/16 inch thick, although thicknesses less than 3/32 inch are not recommended as a general rule. Owing to the thin casting section at the gate, the hot metal for this comparatively large casting must be forced into the cavity through an aperture only 3/16 inch wide by 4 inches long.

Originally, difficulty was experienced in forcing the metal to the extreme points of the die, with the result that blow-holes and too thin walls were obtained. Grooves were then cut in one die member to lead the metal to the distant points. These grooves produce corresponding ribs on the part, which not only reinforce it, but also improve its appearance. The die is designed with the parting line located along one edge of the casting, from which fins can easily be removed.

Cores are pulled from this die on both sides and from the top, these cores being attached to heads *B*, *C*, and *D*, respectively, which are mounted on the stationary member. As with the dies previously described, the casting is made to adhere to the moving member when the die opens. Air vents are seen on this member at *E*. Block *F* on the moving member protrudes a considerable distance into the cavity of the other die half. Ejecting pins may be seen at various points on the moving member. Twenty-five holes are cored in this casting, and by employing the die-casting process for making this part, the machining of an oval opening is obviated, as well as the milling of a semicircular frame recess.

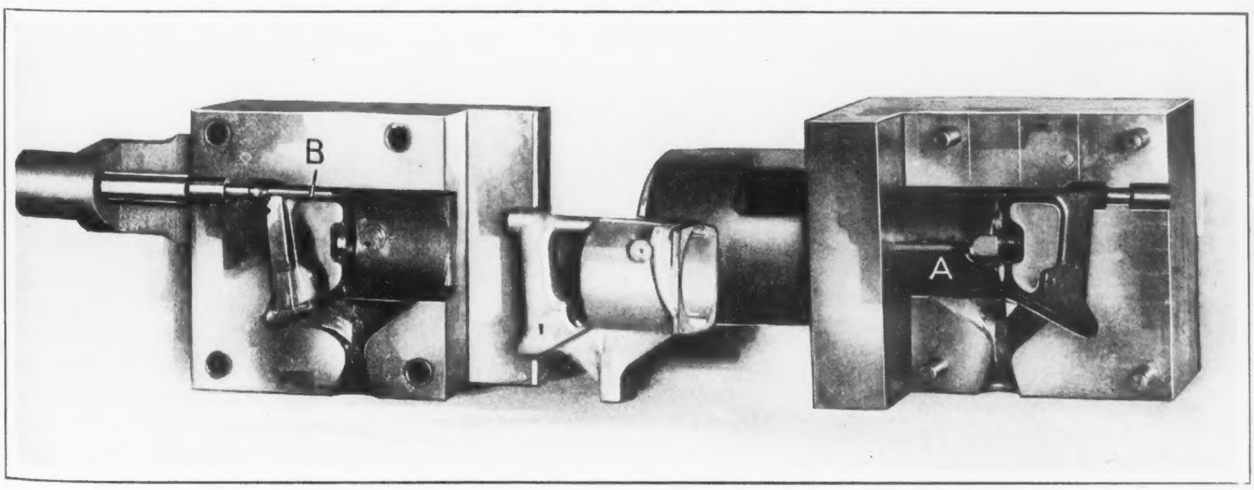


Fig. 9. Construction of Die Used in Casting the Rear Portable Electric Saw Housing Shown in Fig. 7, which Requires the Pulling of a Slender Core from the Handle

Construction of Dies for Portable Saw Housings

Front and rear housings for a portable electric saw are shown in Figs. 6 and 7, respectively. The rear housing is of the general design employed for other portable electric tools, such as drills and grinders. Owing to the fact that there are shaft-holes at right angles to each other in the front housing, a die design of more than passing interest had to be employed. From Fig. 8, which shows the die, it will be seen that one shaft bore is produced by core *A*, which is attached to the stationary die member, while the bore at right angles to the other one, is produced by means of core *B*. Core *B* is advanced to interlock in a groove of core *A* before the operation is performed and is withdrawn from it immediately at the end of the operation, as the die could not otherwise be opened.

Instead of the contact faces of these die members being flat, as in the preceding examples, they are of a stepped construction, as necessitated by the casting design. The parting line occurs along edge *C* of the casting. It will be seen that on the moving member there is a large-diameter core *D* which produces the circular hollow *E* in the work. Core *D* is pulled sidewise to permit ejection of the casting. Ejecting pins are located at various points on the stationary and moving die members, as indicated at *F* and *G*, respectively.

The rear saw housing is produced with the die illustrated in Fig. 9. It will be seen that the stationary member of this die is also equipped with a large cylindrical core *A*, at the center of which there is a small core that must be withdrawn prior to the opening of the die at the end of each operation. The moving die member is equipped with a long, slender core *B*, which produces a hole running from the handle of the housing to the motor compartment. This core is also pulled sidewise after the die has opened, so as to release the casting. Several shallow vents may be seen on the face of the stationary member. The parting line runs along the center of the work. Both the front and rear housings are given a high finish after the gate and flash have been ground off.

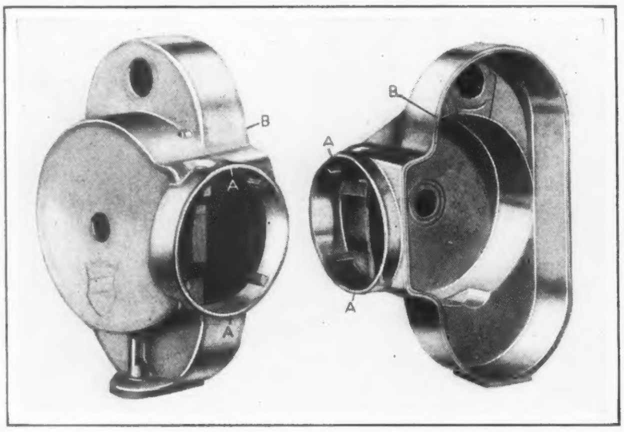


Fig. 10. Two Views of a Die-cast Moving Picture Machine Part

Design of Dies for Moving Picture Machine Parts

The parting edge of the moving picture machine casting shown in Fig. 10 extends about from points *A* on the circular portion, backward until the main part of the casting is reached where it runs out to edge *B* and extends around this edge. Fig. 11 shows the die used for the production of this part. The die is typical of many that produce a trade emblem on the casting with the outline and reading matter clear and distinct.

The moving member of this die has a large stationary core or plug *A* and a vertically sliding core *B*. When the die closes, the hole in block *C*,

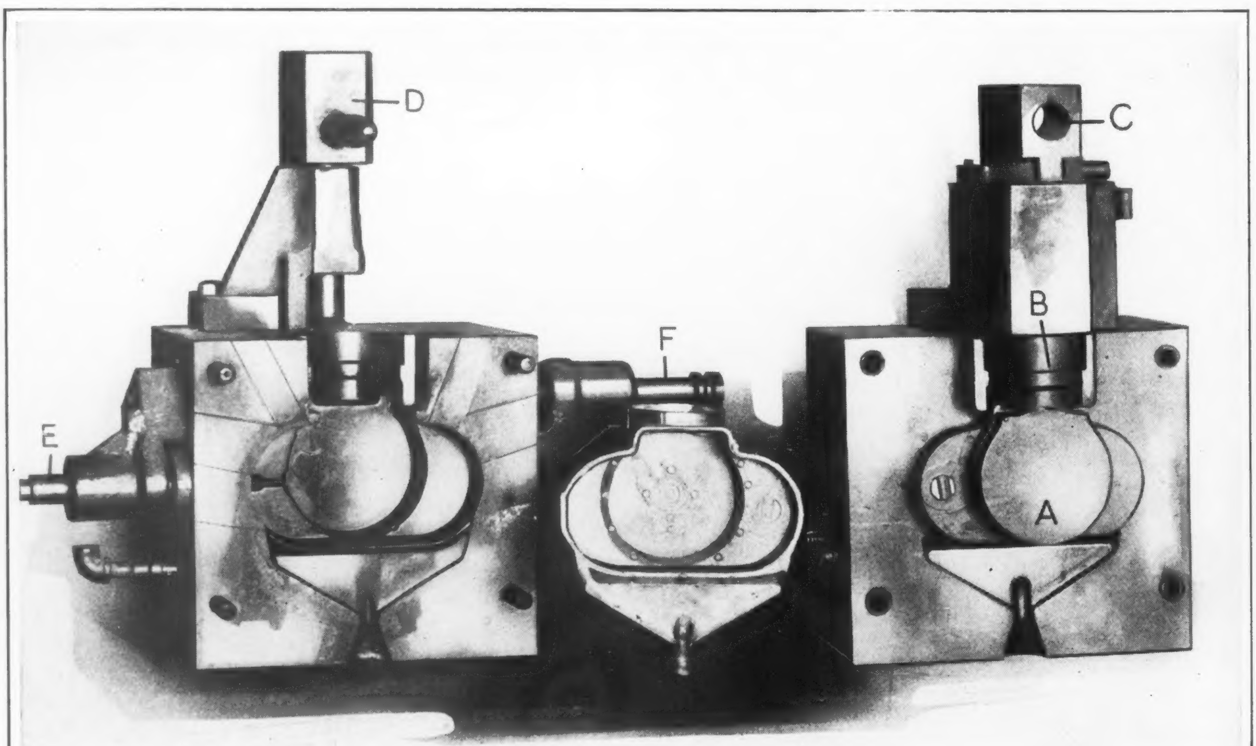


Fig. 11. Die Design Embodying a Heavy Core on the Movable Member which is Operated by a Lifting Device on the Stationary Member

attached to the upper end of the core, slides over the tapered pin held in block *D* of the stationary die, thus accurately positioning core *B* for the casting operation. At the end of the operation, block *D* is raised before the die is opened, core *B* thus being lifted also. When block *C* then slides off the tapered pin on block *D* as the die opens, core *B* again drops into place. Cores are also pulled sidewise from the stationary die by means of rods *E* and *F*.

This casting is made to adhere to the moving die member, although the tendency is for it to remain on the stationary member. The latter is generously provided with ejector-pins, there being eighteen altogether. This part is an aluminum casting measuring approximately 8 by 5 by 2 1/2 inches over-all. It is later given a crackle-laquer finish in various colors.

Fig. 12 shows a die of simple design employed in casting a cover for a heat-regulator housing. Both the movable and stationary members have a core which is pulled from one side, one core from the right and the other from the left. Cores for various other openings and holes are fastened to both the stationary and moving members, as in the dies previously described. Air vents can be clearly seen on the face of the stationary member, which is shown at the right in the illustration. The parting line on this casting runs along one edge.

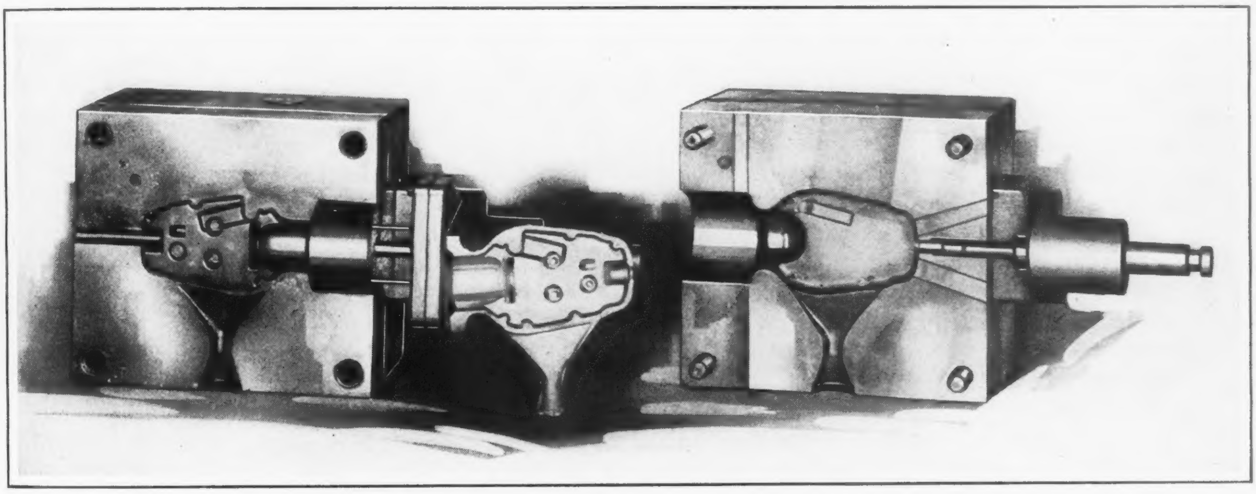


Fig. 12. Simple Die Employed for Producing a Thin Part Having a Circular Flange at One End

* * *

TESTING MATERIALS CONVENTION

The American Society for Testing Materials held its thirty-second annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 24 to 28. Among the sessions of particular interest to the metal-working and machine-building field was one on cast iron, in which a group of brief papers was presented to stimulate discussion on the physical properties of cast iron. Special reference was made to high-strength and alloy cast iron. Among other subjects dealt with were corrosion and corrosion fatigue. Two entire sessions were devoted to the presentation of papers on non-ferrous metals. At the session on steel and wrought iron, a large number of papers relating to various properties of iron and steel were presented.

FIFTIETH ANNIVERSARY OF THE A. S. M. E.

In April, 1930, the American Society of Mechanical Engineers will celebrate its fiftieth anniversary. The ceremonies celebrating this event will be international in character, and engineers of outstanding achievements from all over the world will be invited to participate. At the meeting, emphasis will be laid on the influence that mechanical engineering has had upon the social and economic life of this country and the world, and the way to future development will be pointed out.

The preliminary meeting at which the founding of a society of mechanical engineers was discussed was held on February 16, 1880, in the office of the *American Machinist*. The fiftieth anniversary celebration, therefore, will begin in New York with a visit to the present office of that journal. The final organization meeting of the American Society of Mechanical Engineers was held April 7, 1880, in the auditorium of Stevens Institute of Technology at Hoboken, and on the second day of the anniversary celebration, which will take place during the five days April 5 to 9, next year, the scene of the first meeting will be visited. In connection with this event, Stevens Institute of Technology is preparing an elaborate pageant which will depict the early life of the society.

The last three days of the celebration will be spent in Washington, D. C. Invitations have been issued to engineering societies and engineering schools throughout the world to send delegates to the fiftieth anniversary meeting, which will mark an important milestone in the history of engineering.

* * *

AUTOMOTIVE ENGINEERS' SUMMER MEETING

The summer meeting of the Society of Automotive Engineers was held June 25 to 28 at Saranac Inn, Saranac Lake, N. Y. The technical program included sessions on combustion chamber design, motor truck design, chassis and body design, general bus and motor truck transportation, airship transportation, and research. The meeting also included many recreational and social features, and a sight-seeing tour to the historic points within reach of Saranac Lake.

Making Heavy Machine Frames by Welding

How the Framework and Bases for Gas Plant Machinery are Made by Welding Together Steel Plates and Structural Steel Members

By C. M. TAYLOR, Vice-president, Lincoln Electric Co., Cleveland, Ohio

ALTHOUGH the electric arc welding process has been used for some time in the construction of pipe lines, blast valves, gas holders, purifiers, and tank equipment, the Gas Machinery Co., Cleveland, Ohio, is probably the first company to employ this method of joining steel members in the construction of coke annealing machinery.

When arc-welded construction is used, pattern drawings are not required. This feature results in a considerable saving in time and expense in constructing gas plant machinery or similar equipment where two pieces, identical in size, type, and capacity, are seldom required. The great strength of rolled steel also gives arc-welded steel construction the advantage of light weight combined with rigidity.

By employing arc welding to join the various members, the entire construction actually becomes one piece of steel. In most cases, the welded joints are stronger than the metal members themselves.

All the advantages of arc-welded steel construction were realized in building the coke pusher shown in Fig. 1. This machine is motor-driven, and is used for pushing coke from an inclined gas oven. The ram *A*, which is shown in the fully extended position, is coiled within the machine itself when withdrawn from the coke oven. This is made possible by building the ram of short pieces of 8-inch H-shaped sections, connected on each side by small plates welded to two small shafts previously inserted through holes in the flanges of the H-shaped sections.

This construction forms a flexible link between the different sections, permitting the ram to be coiled within the framework of the machine and yet providing sufficient rigidity when it is extended as shown in the illustration. Round bars 1 inch in diameter, spaced 3 inches apart, are welded in holes which pass through the lower flanges of the H-shaped sections of the ram. These bars, one of which is shown at *B*, form a rack which is engaged by the teeth of the ram driving gear.

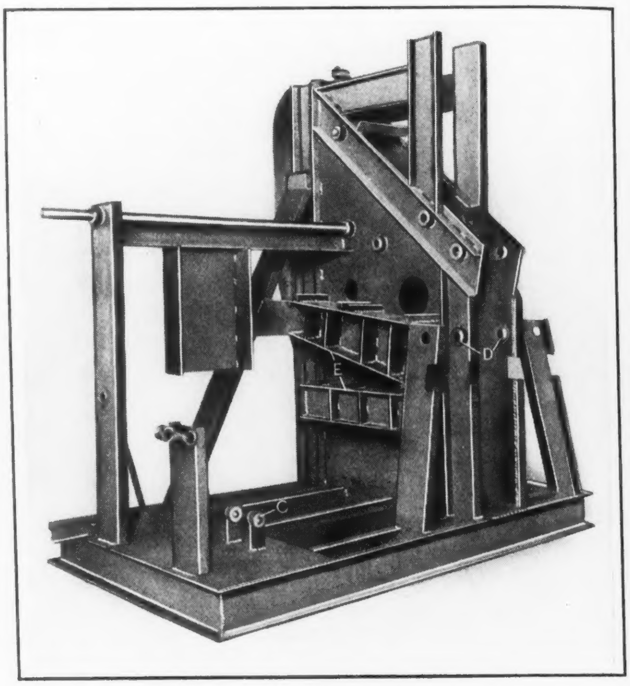


Fig. 2. Arc-welded Frame of Machine Shown in Fig. 1

The simplicity of the arc-welded framework is shown in Fig. 2. Structural channels and steel plate form the various members of the base and frame. The bearing bosses, such as shown at *C*, are simply small pieces of round bar stock, drilled to the proper size and welded in place. In cases where the shafting extends through the frame member, as at *D*, holes the size of the outside dimension of the bearing boss were cut through the member with a gas torch, after which the bosses were inserted and welded in place. At points where heavy loads are to be supported, miniature girders *E* were built up of steel plate and welded together.

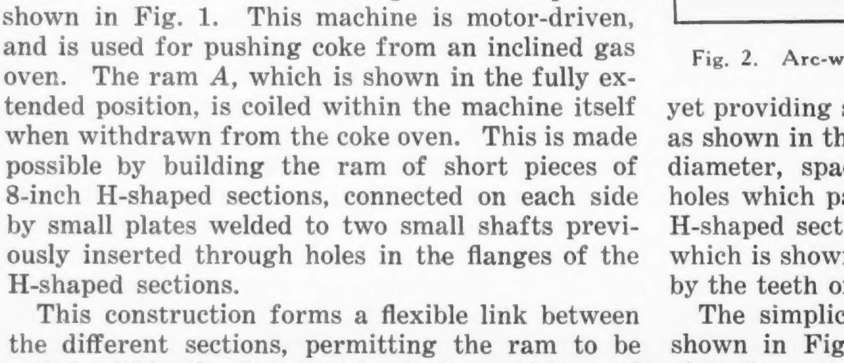


Fig. 1. Coke-handling Machine Constructed Entirely by Arc Welding

* * *

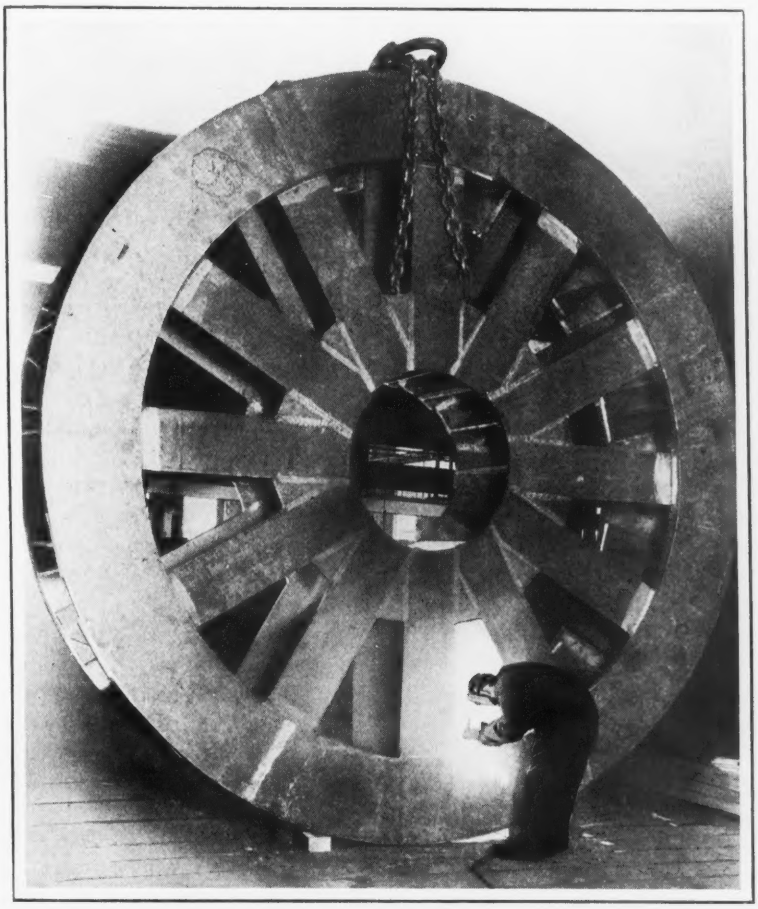
American railroads received last year an average of 1.081 cents for moving 1 ton of freight 1 mile. This represents a decrease of 15.2 per cent, as compared with the rate for 1921.

Notes and Comment on Engineering Topics

The average receipts per passenger mile on American railroads were 2.852 cents in 1928, as compared with 3.086 cents in 1921.

Farming is really America's largest industry; and yet generally it is not thought of as an industry. Statistics show, however, that in farming, there are used power producing machines developing 28,000,000 horsepower, while the horsepower used in all the manufacturing industries is approximately 29,400,000 — only slightly more than is used in farming.

Labor-saving machinery is increasing the productivity of the American farms to an enormous extent. In the state of Iowa power equipment produces 3.86 horsepower per worker employed on the farms. In Great Britain the corresponding figure is only 0.88 horsepower, and in Italy 0.19 horsepower. The relation that the power used has to production is also shown by statistics. If the actual farm production in Italy is given by the index figure 45, that of Great Britain is 126, and of Iowa, 595. It is likely that a few years hence there will be more machinery built for use on farms than for use in our combined manufacturing industries.



Sixteen-foot Arc-welded Steel Spider Weighing 60,000 Pounds, Built by the Westinghouse Electric & Mfg. Co. for a 45,000-kv-a. Waterwheel Generator, Saving 25 Per Cent in Weight over Cast Spider

In an investigation of 4375 cases where men were discharged for other causes than lack of work, it was found that in 25 per cent of the cases inability to do the work for which they were hired was the cause. In about 4 per cent of the cases the reason was that the men, while doing their work correctly, were too slow. In 4 per cent of the cases they were physically unadapted to the character of the work. Eleven per cent were discharged for insubordination, 10 per cent for unreliability, and 10 per cent because they were absent too often. Inclination to taking things too easy accounted for 7 per cent, while 4 per cent were discharged for trouble-making, and 4 per cent for drinking. Three per cent were discharged for violation of rules, nearly 3 per cent for carelessness, and the remainder for miscellaneous causes, such as fighting while on the job and other misconduct.

In a paper on "High-speed Gears," read by E. N. Twogood of the General Electric Co., Lynn, Mass., before the Engineers Society of Western Pennsylvania, the author pointed out that a few years ago a pitch line velocity of 7500 feet per minute was considered the maximum for satisfactory operation of gearing. Today there are gear trains in operation running at a pitch line velocity of nearly 15,000 feet, and engineers in this field see no particular reason why this should be the limiting velocity. As to speed in revolutions, 3600 revolutions per minute was considered high a few years ago, but now some turbine sets are operated at 10,000 revolutions per minute, and some centrifugal compressor sets have recently been installed that operate at a speed of nearly 30,000 revolutions per minute.

The United States Navy is having two airships built at Akron, Ohio, that have a helium gas capacity of 6,500,000 cubic feet. This represents a capacity 75 per cent greater than that of the *Graf Zeppelin.*

At the meeting of the Bolt, Nut and Rivet Manufacturers Association held in Washington, D. C., May 23, it was unanimously decided that the measurement of the length of all bolts shall be made from the largest diameter of the bearing surface under the head to the extreme end of the point. This means that in the case of countersunk head, deck, and elevator bolts, the length of the bolt will be the over-all dimension.

Current Editorial Comment

In the Machine-building and Kindred Industries

STANDARD COLOR FOR MACHINE TOOLS

An important step toward the adoption of a uniform color for machine tools built by the member companies of the National Machine Tool Builders' Association, was taken at the recent convention of the association at Asheville, N. C. On the committee appointed to decide upon a standard color, several of the leading machine tool companies are represented. It is expected that the committee will make its report in sufficient time to permit the use of the standard color on all the machine tools that will be exhibited at the Machine Tool Exposition in Cleveland next September.

Users of machine tools will welcome a standard color as different builders are now using a variety, and the average machine shop where equipment bought from many different manufacturers is used lacks uniformity. The big automobile companies and other large users of machine tools have adopted standard colors of their own, and specify when purchasing that all machines be painted that color. This represents added expense and inconvenience to machine tool builders, because they must paint their machines in different colors according to the wishes of the purchaser.

In future, when all machine tools are painted a standard color, as it is hoped will result from this action, there would be no object in specifying a special color to secure uniformity in large shops. The proposed arrangement by machine tool builders will therefore prove of advantage to both users and manufacturers of shop equipment.

* * *

SKILLED MEN IN MODERN INDUSTRY

There is a popular idea that machines—especially automatics—make the skill of the workman unnecessary. The manner in which these machines perform their work—the sudden stopping and reversal of rotation, the indexing of turrets, the timing and reversal of the motion of slides and the general precision and accuracy by which the machine performs its work, governed by cams, levers and gears, give the casual observer the impression that the machine itself possesses the human attributes of skill and mechanical ability. The popular mind inclines to the idea that such machines come into existence by the pressing of a button and that they keep themselves in repair without attention.

But the use of machinery has not eliminated the need for mechanical skill. The "skill" of the machines originated in the brain that devised the interlocking arrangements of cams, levers, slides, gears and turrets, and was perfected by the tireless mechanical energy of the men who incorporated these ideas into machines of steel and iron. The skill required to produce these modern tools is of a far higher order than any mere manual skill that was developed years ago when accurate work was produced by hand labor alone. And after the machines have been perfected, highly developed skill is still necessary to keep modern machine shop equipment running at its best.

* * *

A VALUABLE SHOP ADJUNCT

Many machinery-building firms now maintain a shop library where their employes may spend a part of the noon hour reading technical books and magazines, and which also may be used for reference purposes by the engineering department and drafting-room. In some shops it has been quite a surprise to find how many of the men spend part of their noon hour in the reading room, and many shop managers say that the small cost of maintaining a shop library has proved a good investment.

The reading room need not be elaborate; a corner of the shop, partitioned off and provided with shelves, chairs and reading tables, will do. The leading technical journals are kept on file there and also books on machine shop practice and design.

The value of a shop library can be greatly enhanced if some well-informed man is placed in charge of it during the noon hour, so that employes wishing to obtain information on some specific subject may be helped to find the book or magazine containing it. This man could also easily determine, through the questions asked, what kind of journals and books are in the greatest demand, and the kind of information the men need most.

* * *

COMPRESSED AIR FOR OPERATING WORK-HOLDING DEVICES

Recently there has been a growing demand for quick-acting clamping devices to be used on machine tools, which has caused a marked advance both in the design and the range of application of pneumatically operated chucks and work-holding fixtures. One advantage of air-operated devices is that usually they can be applied to present machines with but little modification. On automatic machines it has been found convenient to operate certain mechanisms through clutches, levers and other purely mechanical means, while the work-clamping and holding means are operated pneumatically. This combination lends simplicity to the design; and the rather complicated mechanisms usually required for clamping, holding and ejecting the work by cams and levers are avoided.

As the use of compressed air for operating work-holding devices will doubtless increase, the application of this convenient means for that purpose is well worth studying in connection with the design of semi-automatic and automatic machinery.

How to Become a Successful Foreman

Third of a Series on Foremen's Conferences Organized to Develop Leadership, Foster Cooperation, and Increase Efficiency

LAST fall, the Cincinnati Branch of the National Metal Trades Association organized a group of executives from various plants for the purpose of discussing foremen's conferences and training leaders to organize and conduct such conferences in their own plants. A number of meetings were held, and during these, topics were discussed in much the same way as they would be in the regular foremen's conferences later to be organized in the various plants. The ideas relating to foremanship that were brought out in these conferences are of interest to the entire metal-working industry, and brief summaries of the different discussions are, therefore, presented here.

What are the Main Duties of a Foreman?

Briefly summarized, the main duties of a foreman, as brought out in one of the conferences referred to, are to set a good example for his men and to direct their efforts so that they will result in the greatest benefit, both to the company and to the men themselves. To do this effectively, he must study his job so that he can give correct and explicit instructions to his men and see that these instructions are carried out. He will not be successful if he thinks that he can hand any piece of work to any man in the department and expect him to do it to the best advantage. He must know how to fit the man to the job and the job to the man, and must be a sympathetic teacher, not only of beginners, but also of the older employes when new problems arise.

This means that he must develop the quality of giving and obtaining cooperation. He must not only offer suggestions himself, but must encourage his men to do likewise. If he is able to do this, he has the leadership qualities that will establish a feeling of good faith between the men and the management, and will result in increasing the morale of his department.

In his relations to the management, he should make it a point to know the company's policies, as thoroughly as possible, so that he can carry them out with confidence. He must, himself, abide by the rules and regulations that he expects his men to live up to. He must make it a rule to execute orders promptly, plan the work of his department definitely, maintain the established standards of quality, and insist on safe working practices. A foreman who is able to meet all these requirements generally has a bigger job ahead of him.

One thousand foremen were asked to list the qualifications that they considered important in filling their jobs efficiently. They were asked to give a rating to each quality, in order that the importance they attached to each might be recorded. The ability of the foreman to plan his work was given the highest rating in this test. The next highest ratings were given to the following qualities: Leadership, knowledge of tools and equipment, ability to keep his men, ability and tact in enforcing management policies, and efficiency in the supervision of work while in process. Technical knowledge of his work, a square attitude toward men and management, and a sense of responsibility toward the men working in his department were also listed as qualifications of great importance.

How Foremen Rate Their Own Qualifications

At one of the conferences, a summary was presented of the opinions of more than one thousand foremen as to the qualities that they consider important in filling their jobs efficiently. The importance of the different qualifications, as judged by the foremen themselves, was established by a rating system.

It is evident that, when so large a number of men were asked to list and rate the qualifications that they considered essential to the success of a foreman, they would list many that were quite similar and yet not identical. Hence, in the paragraphs that follow there is a certain amount of duplication, but the list is a good guide to the many problems that the foreman must face; and, although there may be differences of opinion as to their rating, no one will deny the importance of them all.

Certain qualifications that may be of less importance in one plant will rank higher in another. In large plants, for example, where special departments are organized to engage wholly in developing improved methods, the foreman of a manufacturing department may not be much concerned with devising improved shop methods. In a small plant, again, the development of improved shop methods depends largely on the foreman, and would rank among the most important of his duties.

The foreman's ability to plan his work was given the highest rating. The next highest ratings were given to the following qualifications: Leadership, knowledge of tools and equipment, ability to keep his men, to enforce management policies, and to supervise the work while in prccess.

In the group considered to be of next importance were the following qualifications: Technical knowledge of his work, a square attitude toward men and management, and a sense of responsibility toward the men working in his department. In this group were also listed his efforts to maintain his own mental and physical health and vigor, his efforts to look after building maintenance, and his sense of responsibility for fire hazards.

In the next group are listed the following qualifications: Ability to execute his plans, willingness to cooperate, ability to satisfy both the men and the management, ambition and the desire to develop himself in his job, ability to supervise mechanical processes, interest in the general welfare of the employes, care in periodic inspections of

equipment, and effort to make himself liked by his men.

Among the qualifications that were considered desirable but not rated as of first importance are his interest in the home conditions of the men, encouragement of improved methods, ability to interpret the management policies to the men, knowledge of costs, ability to satisfy both the men and management on questions of wages, ability to train understudies, willingness to accept criticism, and ability to handle complaints both from above and below.

The Three Divisions of a Foreman's Job

At another conference the foreman's job was subdivided into three different divisions—supervision, management, and instruction. Under the heading "supervision" his duties were listed as follows: He must see that the work is flowing through his department as planned; that the machines are operating according to accepted standards; that orders are carried out as intended; that his men are properly taken care of, so that they work under conditions satisfactory to themselves; and that the product meets the required standards.

As a manager he must be a "doer"—that is, he must see that the work is done on scheduled time, he must hold department costs to a minimum, he must keep posted on rules and policies, and he must keep his department clean and orderly.

As an instructor, he must teach his men how to do their work, and must give especial attention to all new men to see that they thoroughly understand the work they are supposed to do, and that they receive any needed instruction, no matter how simple.

Very often the teaching part of a foreman's job is his weak point. There are many other phases of this part of the job besides telling the men how to do the work. The foreman must develop skilled workmen. He must do it in such a way as to gain the confidence of his men. Teaching by simply giving orders does not encourage cooperation or instill loyalty in the worker. In addition to instructing the men in the most efficient method of doing the work, he should teach the value of order and discipline, and stress safe working methods. He should give the men an idea of what is considered satisfactory quantity and quality of work, thereby eliminating waste and reducing the cost of the product. The proper use and care of machinery and tools is also one of the subjects that should be taught to every man. The teaching part of a foreman's duties constitutes, in itself, a man-sized job.

The Broader Aspect of Instruction

A foreman can aid his men to a great extent in becoming proficient by calling their attention to reading matter related to their jobs. He can encourage the men to greater effort by calling their attention to the success of other men who have started in positions similar to those that they hold. He should impart some technical knowledge related to the job, as well as instruction that pertains merely to how it is to be done. Encouraging the men to attend night school or to benefit by outside study and observation as a supplementary means of education will create a friendly feeling and help to develop the men.

How Shall the Foremen be Trained to Train?

We now come to the important point in the entire procedure. If one of the important functions of the foreman is to train his men, how shall he himself be trained for this task? Few men are equipped by nature to be good teachers. It is here that the foremen conference plan is brought in to aid the foremen in performing the training part of their work. In the foremen's conference, the foremen tell each other how to teach. In other words, they train themselves to train. The management can aid the foremen in these conferences by selecting a leader who understands this phase of the foreman's duties.

During the conferences, for example, each foreman should demonstrate a teaching job before the group, and the group should then tell him what they think of it and offer suggestions. Through the conferences, the foreman will be encouraged to plan the instruction that he gives to his men. He will gradually acquire the idea that it is necessary to prepare for instructing a beginner, to present the instruction properly to the man, and to see that he applies the instruction correctly.

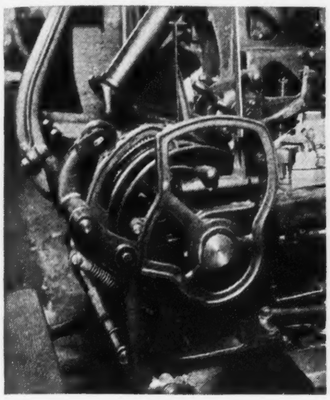
* * *

A Tool Control System That Pays

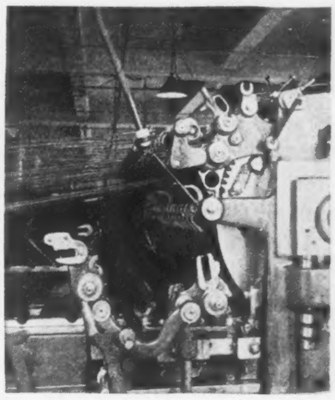
Through the adoption of a tool engineering and control system, the DeLaval Separator Co. has found it possible to reduce the annual expenditures for small tools, jigs, fixtures, etc., by $100,000. At the same time, the capital tied up in small tools carried in stock has been reduced over $65,000. The system that has made it possible to accomplish these savings will be described in August MACHINERY. A complete set of forms used in connection with the system will be shown, and detailed information as to its operation will be given. In addition to the economies obtained, the service rendered to the production departments has been improved, and in many instances tools of better quality are now being used in the shop.

WESTINGHOUSE NIGHT WELDING SCHOOL

The increasing need for practical instruction in electric arc welding has induced the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to conduct night classes in practical arc welding. The night course was started for the benefit of employes who could only attend the welding instruction course at night, but is now open to anyone desiring arc welding training. A small tuition fee is charged for the three months' course. The classes consist of two groups, each group meeting two nights a week for three hours each night. The enrollment is limited so that each man taking the course may receive individual training and instruction in the various phases of electric arc welding. Instruction is also given in a day welding school, which is open to buyers or prospective buyers of arc welding equipment and their employes. No charge is made for the instruction given in the day course. The courses provide a training that will enable those attending them to properly use welding equipment.



Ingenious Mechanical Movements



MECHANISM OF A HEAVY OIL METER

By CAMILLO FRANCHI

The heavy oil meter shown by the sectional view is so designed that as the oil passes through it from inlet to outlet, the amount is indicated by a dial which may be arranged to read either in gallons or liters, pounds or kilograms. The flow of oil through the meter traverses piston *A*, which by striking rods *B* and B_1, controls the shifting of slide valve *C*. This slide valve, which operates on the same principle as the slide valve of a steam engine, so far as port arrangement is concerned, connects opposite ends of the cylinder alternately with the inlet and outlet.

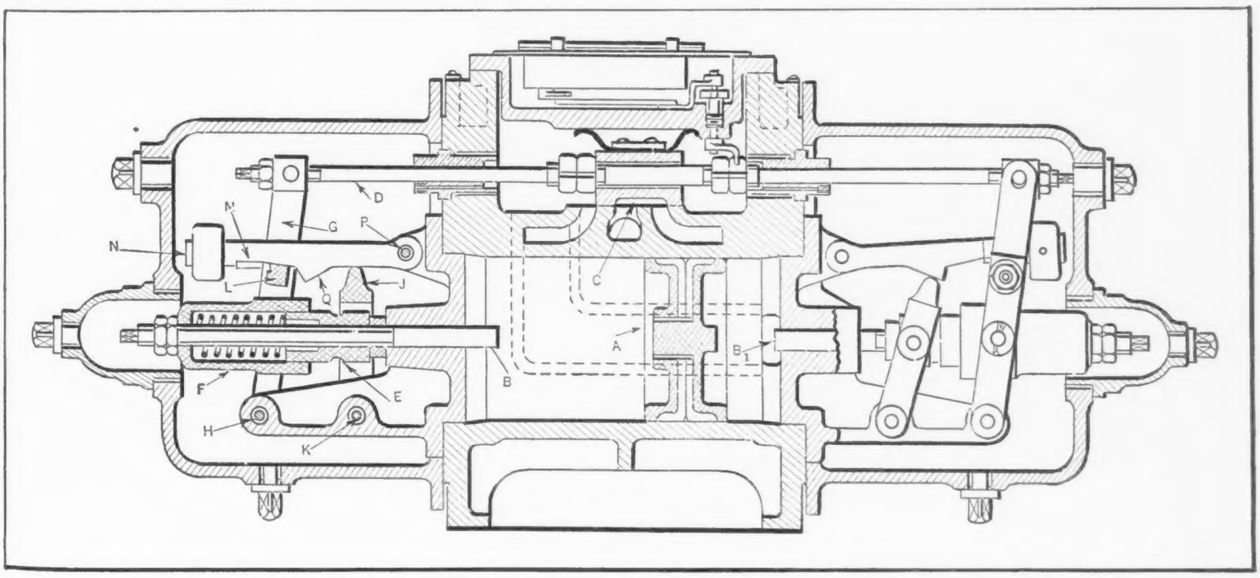
The valve control mechanism located between rod *B* and valve rod *D* is the same as the mechanism between rod B_1 and the valve rod, so that it will only be necessary to describe the action of one side. Rod *B* which passes through a reamed hole in the cylinder head, is screwed into sleeve *E*. Between this sleeve and cap *F* there is a compressed spring. Lever *G* swings about fulcrum *H* and it is pivoted to cap *F*. The upper end also connects through an adjustable block with valve rod *D*. Lever *J* swings about fulcrum *K* and is pivoted to sleeve *E*.

A small difference in the oil pressure on the opposite sides of piston *A*—say of 1.5 or 2 pounds per square inch—is sufficient to set the piston in motion. If we assume that oil is entering the right-hand end of the cylinder and flowing out of the left-hand end, then the piston will move to the left. When it strikes against projecting rod *B* and moves sleeve *E* and lever *J* to the left, the spring within nut *F* is compressed, but lever *G* remains stationary because part *L* engages a stop *M* on the counterweighted lever *N* which is pivoted at *P*.

The spring compression increases until lever *J*, by coming into contact with cam surface *Q*, raises lever *N*, thus disengaging stop *M* from part *L;* then lever *G* swings quickly to the left, thus shifting valve *C*. Oil now enters the left-hand end of the cylinder and flows out of the right-hand end as the movement of piston *A* is reversed. When the piston engages rod B_1, the mechanism at the right-hand end repeats the cycle of movements just described.

The adjustment of rods *B* and B_1 serves to vary the capacity of the main cylinder according to the amount that these rods project into it, or according to the amount they limit the piston stroke. In this manner the oil cylinder capacity may be varied 15 per cent above or below the normal capacity. Consequently, if liquids have a constant specific weight, the meter may be calibrated to measure either by volume or by weight.

It will be noted that valve *C* has a certain amount of free axial movement on the valve rod and a



Mechanism of a Heavy Oil Meter

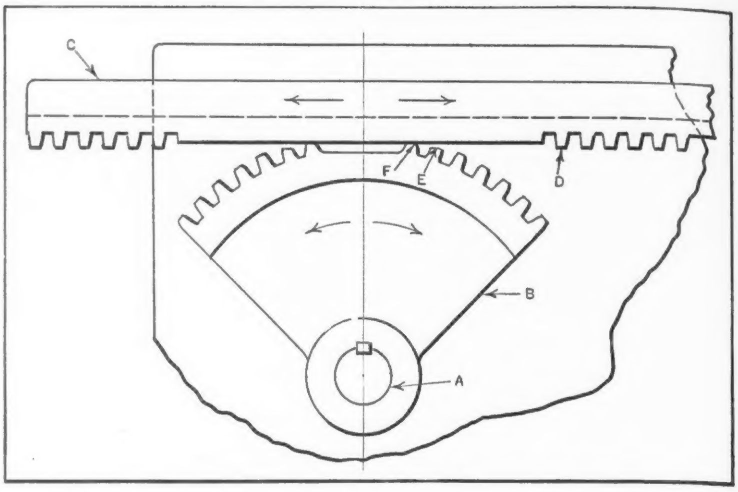
spring bearing against the valve chamber cover holds the valve against its seat. The play of the valve on its rod serves the purpose of freeing the rod from sudden stresses liable to develop from friction of the valve on its seat in the reversal. On the outside of this valve chamber cover is located the registering mechanism. The piston A is fitted with a leather packing and it operates in a ground cylinder. This apparatus is suitable for pressure ranges varying from 5 pounds to 150 pounds per square inch and for fuel oil of varying degrees of viscosity. This meter has been applied successfully in furnishing daily records of the fuel oil consumption of iron melting furnaces, and it is intended for similar applications, and also for checking boiler feed water consumption.

* * *

INTERMITTENT MOTION FROM RECIPROCATING RACK

By J. E. FENNO

The intermittent motion to be described is part of a device for feeding brass shells to a dial press. In the operation of this feed mechanism, it was necessary to turn shaft A and segment gear B through part of a revolution at each end of the stroke of reciprocating rack C. The illustration shows the segment gear in the dwelling position. As the rack moves, say, to the left, the rack teeth beginning at D engage the segment gear and turn it. When the rack reverses, the segment gear is turned in the reverse direction until the rack teeth at the right leave it, and then dwell occurs until the teeth on the left-hand side engage the segment gear. Tooth E (and the corresponding tooth on the opposite side) is cut away to avoid interference as D comes into contact with F.



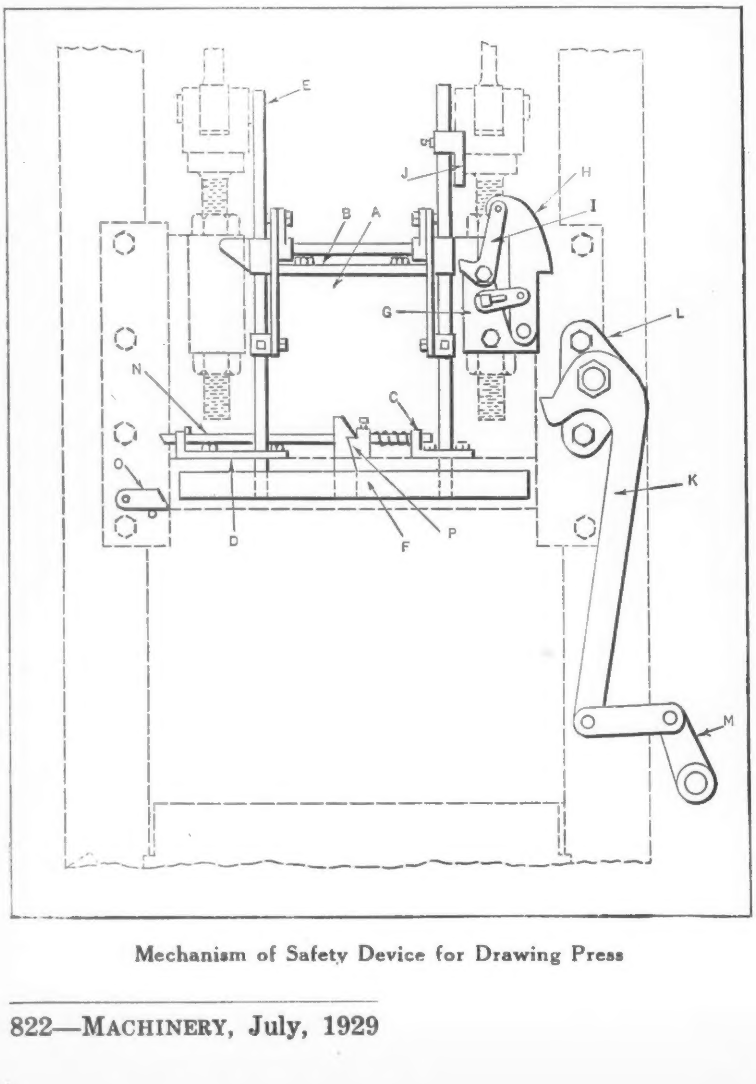
Reciprocating Rack which Engages Segment Gear at Each End of its Stroke

* * *

SAFETY DEVICE FOR LARGE PRESS

By JIM HENDERSON

Following a serious accident to an operator some time ago, the writer was asked to design a safety device for a large double-acting toggle drawing press. The device, as designed and constructed, is shown in the accompanying illustration. The various parts constituting the device are shown in full lines, and the parts of the press to which they were attached are shown by dotted lines. The mechanism is so arranged that the bar F, which is located in front of the die and punch, falls as soon as the press is tripped. Should the operator's hand or arm be in the danger zone, it will stop the fall of the bar which, in turn, stops the downward movement of the press ram.



Mechanism of Safety Device for Drawing Press

To the blank-holder cross-head A are secured the brackets B, C, and D. These brackets support the perpendicular guide rods E. To the lower ends of rods E is secured the safety bar F. The bracket G carries the safety tripping dog H, operated by the bellcrank I, which is actuated by the adjustable stop-dog J. The gooseneck lever K, mounted on bracket L, is connected to the clutch by means of a link and a crank M.

The operation of the device is as follows: When the clutch lever is pulled over to the operating position and the clutch engaged, the cross-head starts to descend; the left-hand end of the trip-rod N then comes in contact with pawl O. The resultant movement of rod N releases latch P from the rod on bar F. This allows the safety bar to drop. If no obstruction in-

tervenes, the safety bar falls to its set position, permitting stop J to come in contact with the short end of bellcrank lever I, which pulls the tripping dog H to the left and permits the blank-holder to continue its descent.

Should the operator's hand, arm, or any other obstruction be within the danger zone, the safety bar will not descend to the safety zone, and the stop J will not come in contact with the lever I. The tripping dog H will therefore remain in the operating position. The hook on the tripping dog thus strikes a similar hook on the gooseneck lever K, forcing the clutch out of engagement and thus stopping the press. When the blank-holder is at its lowest position, the latch P is again engaged and the safety device carried upward with the cross-head.

* * *

DOUBLE-ACTING CLIP-BENDING TOOL

By A. EYLES

The simple hand-operated tool shown in Fig. 1 is used for forming the steel clips which bind together the coil springs of passenger car mattresses. This tool is used instead of a standard inclinable power press fitted with an automatic single roll feed, because the quantity of work is not large enough to warrant the investment in such a machine.

At A is shown a section of the steel clip as produced by this hand-operated tool. A perspective view of the clip is also shown at B, and section C illustrates the shape of the clip after it has been secured to the springs by means of other tools not shown.

This bending tool consists chiefly of a die D, a

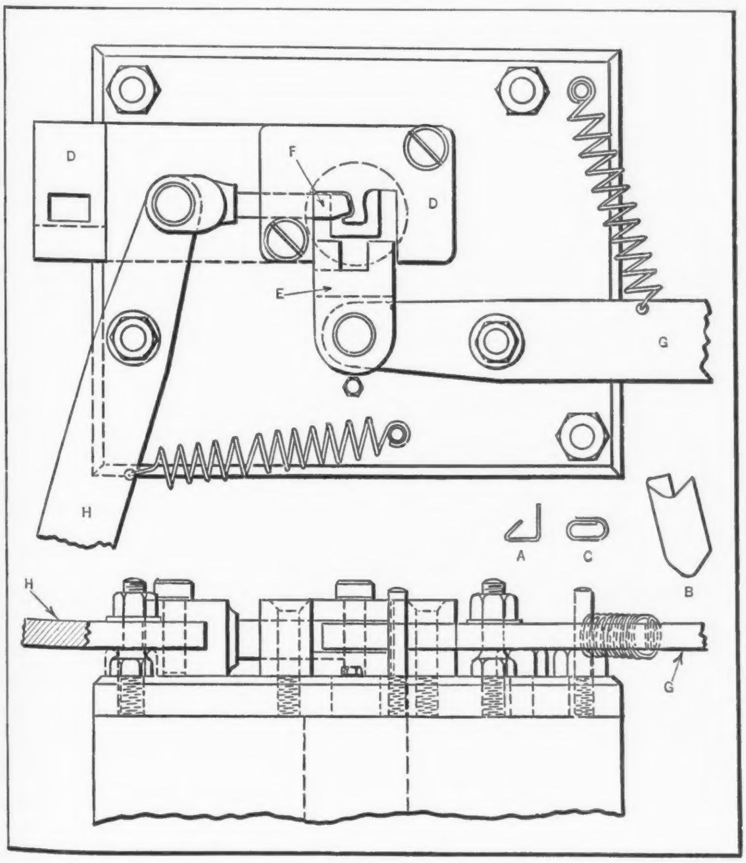


Fig. 1. Hand-operated Clip-bending Tool

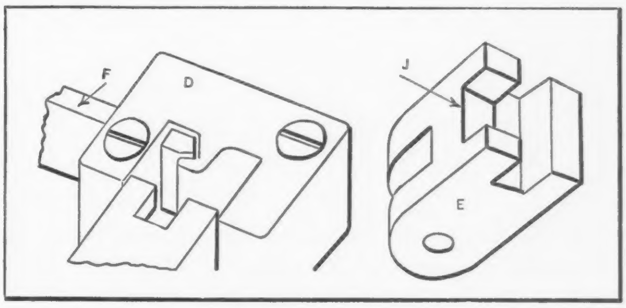


Fig. 2. Die and Bending Tools

former E, and a punch or plunger F. Former E is operated by hand-lever G, and punch F by hand-lever H. Each lever is equipped with a spring, as shown, to return it after the working stroke. Punch F passes through a slot in die D (see also perspective view, Fig. 2), and the former E is also slotted, as shown at J, Fig. 2, to receive punch F.

The operation of this tool is as follows: The sheet-steel blank is fed into the die and then former E is operated by lever G, thus forcing the blank into the die and forming a U-shaped bend. Punch F is then forced into the position shown by the plan view, Fig. 1, thus completing the bending operation and producing the shape illustrated at A and B. When the levers are released and the tools withdrawn by the action of the springs, the clip drops through an opening in the base. (Note that the coil spring attached to lever H is omitted in the front view to avoid confusion of lines.) This tool has an output of 1200 to 1250 clips per hour.

* * *

The practical man frequently decries the efforts of the man engaged in pure science. Helium, the incombustible gas that has recently been introduced as a filling gas for balloons and dirigibles, was discovered in 1868, when scientists observed its presence in the sun through the spectroscope. It was not until twenty years later, however, that the presence of the gas was discovered on earth.

The discovery of helium in the United States was attended by rather an amusing incident. While celebrating the opening of a new natural gas-well in Dexter, Kans., the owner of the well, in order to make the event dramatic, thrust a lighted torch into the outrushing gas and the torch promptly went out. Several more attempts were made, but the gas refused to burn. A sample of the gas was sent to the University of Kansas, and it was found to contain 1.84 per cent of helium. At that time, no one knew of any practical use for helium, and millions of cubic feet were allowed to escape into the air.

The qualities that now make this gas so valuable for use in balloons and dirigibles are its lightness and incombustibility. Because of the latter quality, it is preferable to hydrogen, which is highly inflammable, although lighter. The lifting power of helium, however, is 93 per cent of that of hydrogen.

PORTABLE ELECTRIC TOOLS IN A TRUCK-MANUFACTURING PLANT

The value of portable tools that can be carried to the work, instead of having to take the work to the tool, is generally recognized, but the extent to which these tools can be applied in automobile and truck plants may not be fully appreciated. The accompanying illustrations show a number of applications in plants of leading truck manufacturers, the tools in this instance being those made by the Independent Pneumatic Tool Co., Chicago, Ill.

In Fig. 1 is shown a high-frequency electric nut-setter provided with a heavy-duty malleable gear-case and bracket, so that it may be mounted on a stand, as shown. In the application indicated, the tool is used for tightening nuts from 13/16 up to 1 1/4 inches across flats, in assembling springs to the rear axle. The tool runs at 200 revolutions per minute, and is equipped with a Thor double slip clutch with "kick-out" nut-driving attachment.

The illustrations on the opposite page show other applications of electric portable tools. In the upper left-hand corner is shown an electric screwdriver used for driving 1/4-inch nuts for assembly work on the rear quarter of the body frame. The operating speed is 670 revolutions per minute. The weight of the tool is only 12 pounds, making it easy for the operator to handle it rapidly and without fatigue. In the upper right-hand corner is shown another electric nut-setter driving the front shackle bolts, while the center illustration shows a nut-setter driving 1-inch hexagon nuts in assembling wheel, tire, and rim. This is a tool of heavier construction, weighing about 36 pounds and running at a speed of 650 revolutions per minute.

In the lower left-hand corner a nut-setter is being used for setting nuts on U-bolts in the rear axle and spring assembly. To the right is shown an electric screwdriver being used to set 5/16-inch nuts for fastening the harness clips on the cowl.

* * *

MEETING OF FOREMEN'S ASSOCIATION

The sixth annual convention of the National Association of Foremen was held in Indianapolis Friday and Saturday, June 7 and 8. At the meeting, James J. Davis, Secretary of Labor, Washington, D. C., spoke on "Opportunities in Industry," and Alfred Kauffmann, president of the Link-Belt Co., Chicago, Ill., spoke on "Some Trends in Industries." Many other prominent speakers addressed the association. The subjects dealt with covered wage and production incentives, how to interest men in order and in care of property, elimination of waste in industry, the development of personality, keeping men interested in their work, budgetary control for foremen, planning the work of departments, and advantages to be gained from shop foremen's clubs. The National Association of Foremen has 12,000 members, who, in turn, are grouped in local organizations in the larger industrial centers east of the Mississippi River.

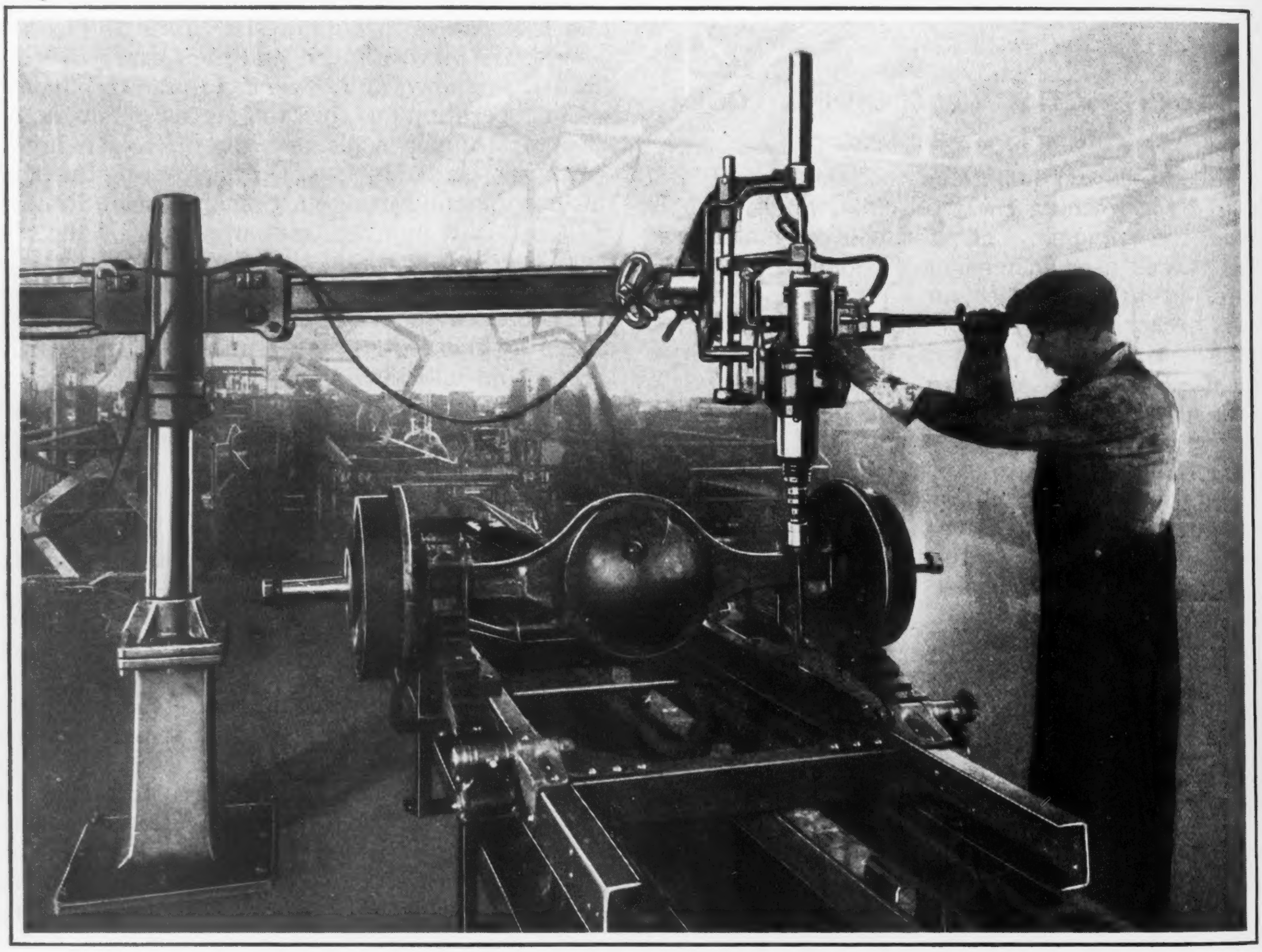


Fig. 1. Electric Nut-setter Mounted on a Stand for Tightening Nuts up to 1 1/4 Inches across Flats, in Rear Axle Truck Assembly

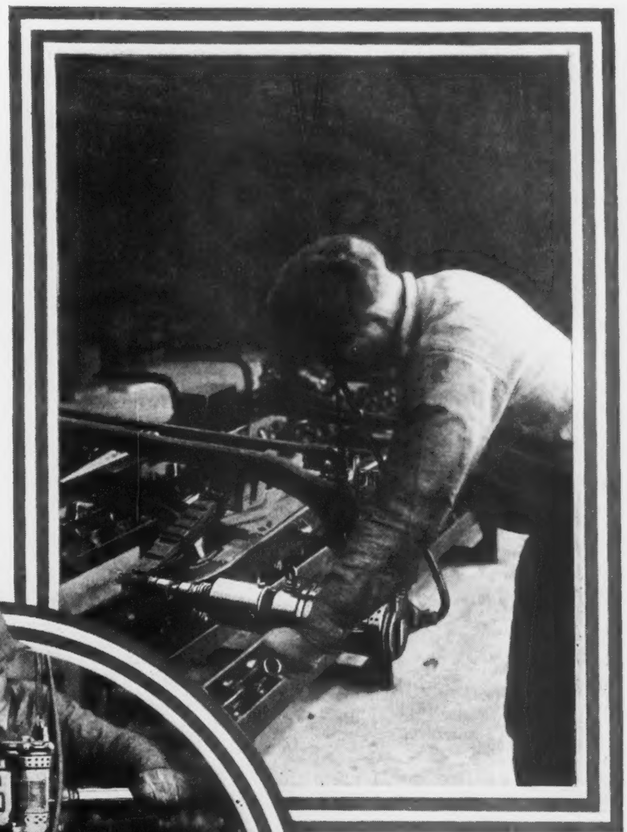


Fig. 2. (Upper Left) Electric Screwdriver, Weighing Only 12 Pounds, Employed for Setting 1/4-inch Nuts. Fig. 3. (Center) Driving 1-inch Hexagon Nuts in Wheel Rim Assembly. Fig. 4. (Lower Left) Driving Nuts on U-bolts in Assembling Rear Axle and Springs

Fig. 5. (Upper Right) Nut-setter Provided with Double Slip Clutch and "Kick Out" Nut-driving Attachment, Used for Driving Front Shackle Bolts. Fig. 6. (Lower Right) Electric Screwdriver Used for Setting 5/16-inch Nuts for Fastening Harness Clips on the Cowl

Static Deflection of Torsional Springs

Charts for Finding the Static Deflection of Torsional Springs Made from Round or Square Wire of Different Gages

By J. W. ROCKEFELLER, Jr., Consulting Engineer, New York

THE accompanying charts are used to determine the static deflection and the fiber stress in torsional springs. In addition to being used for determining these properties under static loads, they can be used in connection with charts shown in the preceding articles on helical springs, for determining kinetic properties of torsional springs. The four factors represented on each of the charts are:

1. The horizontal lines indicate the length R of the twisting arm, in inches. This distance is taken from the center of the helix to the point at which the load is applied.
2. The vertical lines show the deflection f_t per one inch length of wire under a static load of 100 pounds applied at the end of the twisting arm. This deflection is based upon the material having an elastic modulus (in bending) of 10,000,000 pounds per square inch.
3. The heavy oblique lines represent the theoretical fiber stress s_t in the material, in pounds per square inch, when a load of 100 pounds is applied at the end of the twisting arm.
4. The light oblique lines represent the diameter d of the wire from which the spring is coiled.

In the chart Fig. 1, the light oblique lines correspond to the Washburn & Moen sizes for circular section wire. In Fig. 2 they correspond to the sizes of square wire, expressed in fractions of an inch, and in Fig. 3 to the Brown & Sharpe gage sizes for circular section wire. The method of using the charts is illustrated by the following examples.

The modulus of elasticity in tension of some of the more common spring materials may be taken approximately as follows, in millions of pounds per square inch: Steel, 28; phosphor bronze, 15; brass, 14; and monel metal, 24.

Example 1—A torsional coil spring is made of No. 10 Washburn & Moen gage steel wire. The total length L of the wire in the spring, not including the amount required to form the end, is 30 inches. The length of the arm (that is, the distance from the center of the coil to the point at which the load is applied) is 1 1/2 inches. The force W acting at the end of the moment arm is 15 pounds. Assume the modulus of elasticity E of the material to be 28 million pounds per square inch.

Determine the linear distance through which the end of the arm will travel when the load is released. Also determine the fiber stress in the wire when under load.

Referring to the chart Fig. 1, we first find the point at which the line representing the No. 10 wire, intersects the horizontal line representing a length R of 1.5 inches. We find the corresponding value for f_t equal to 1.4 inches, which is the deflection for each linear inch of length L of the spring, under a load of 100 pounds, assuming a modulus of elasticity of 10 million pounds per square inch.

The total torsional deflection F_t in the example given is now found by the following formula:

$$F_t = f_t \times L \times \frac{W}{100} \times \frac{10}{E}$$

Inserting the values f_t, L, W, and E, we have

$$F_t = 1.4 \times 30 \times \frac{15}{100} \times \frac{10}{28} = 2.25 \text{ inches}$$

Again referring to Fig. 1, we find that the fiber stress s_t under a load of 100 pounds is approximately 630,000 pounds per square inch. To obtain the fiber stress S_t under the actual working conditions, use the formula:

$$S_t = s_t \times \frac{W}{100}$$

Substituting numerical values we have,

$$S_t = 630{,}000 \times \frac{15}{100} = 94{,}500 \text{ pounds per square inch.}$$

Example 2—A torsional spring has an outside diameter of 2 inches, is made of No. 18 Washburn & Moen gage wire, contains five complete turns or coils, and the length of the twisting arm is 1 1/2 inches. Assuming the modulus of elasticity in tension E to be 28 millions, determine the number of turns which the arm would make if subjected to a turning force of 1 pound at its outer end. Also find the fiber stress in the material.

Since the outside diameter is 2 inches, we have the mean diameter $D = 2 - 0.047 = 1.953$ inches. The total length of wire, exclusive of that required to make up the twisting arms, is found by the formula $L = \pi DN$, in which L = the total length of the wire, D = the mean diameter of the spring, and N = the number of turns or complete coils. Substituting numerical values in this formula we have,

$$L = 3.1416 \times 1.95 \times 5 = 30.8 \text{ inches}$$

Now referring to Fig. 1, we locate the horizontal line corresponding to a length R of 1 1/2 inches for the twisting arm. We then follow this line to the right to the point where it intersects the oblique line representing No. 18 Washburn & Moen gage wire. From this point we follow the vertical line downward to the bottom of the chart, where we find the static torsional deflection for a 1 inch length of wire under a load of 100 pounds to be 91. Now as the point of intersection of the horizontal line representing the length of the twisting arm and the vertical line representing the static torsional deflection of 91 is located at a point between

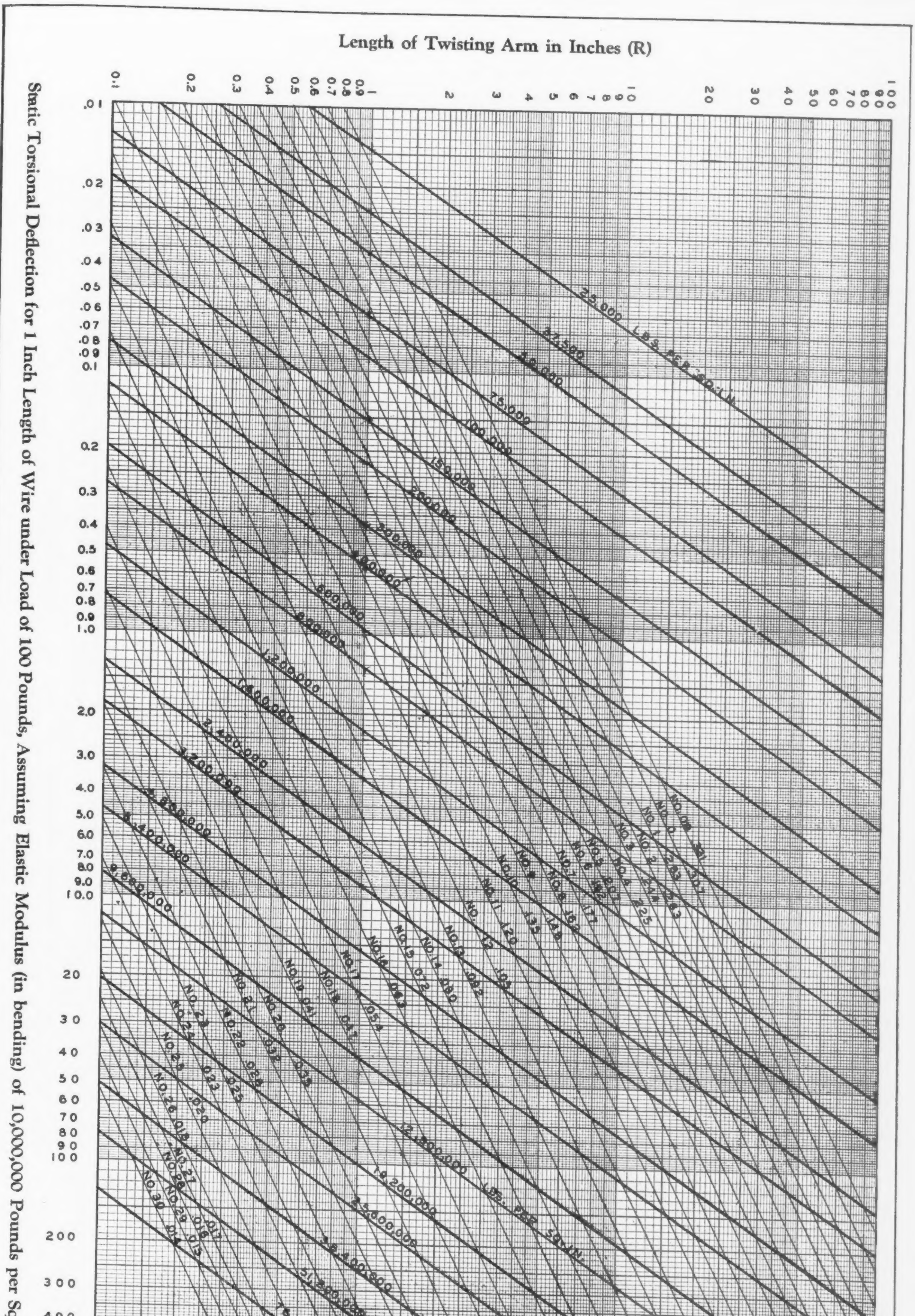


Fig. 1. Chart for Determining Static Deflection of Torsional Springs Made of Washburn & Moen Gage Wire

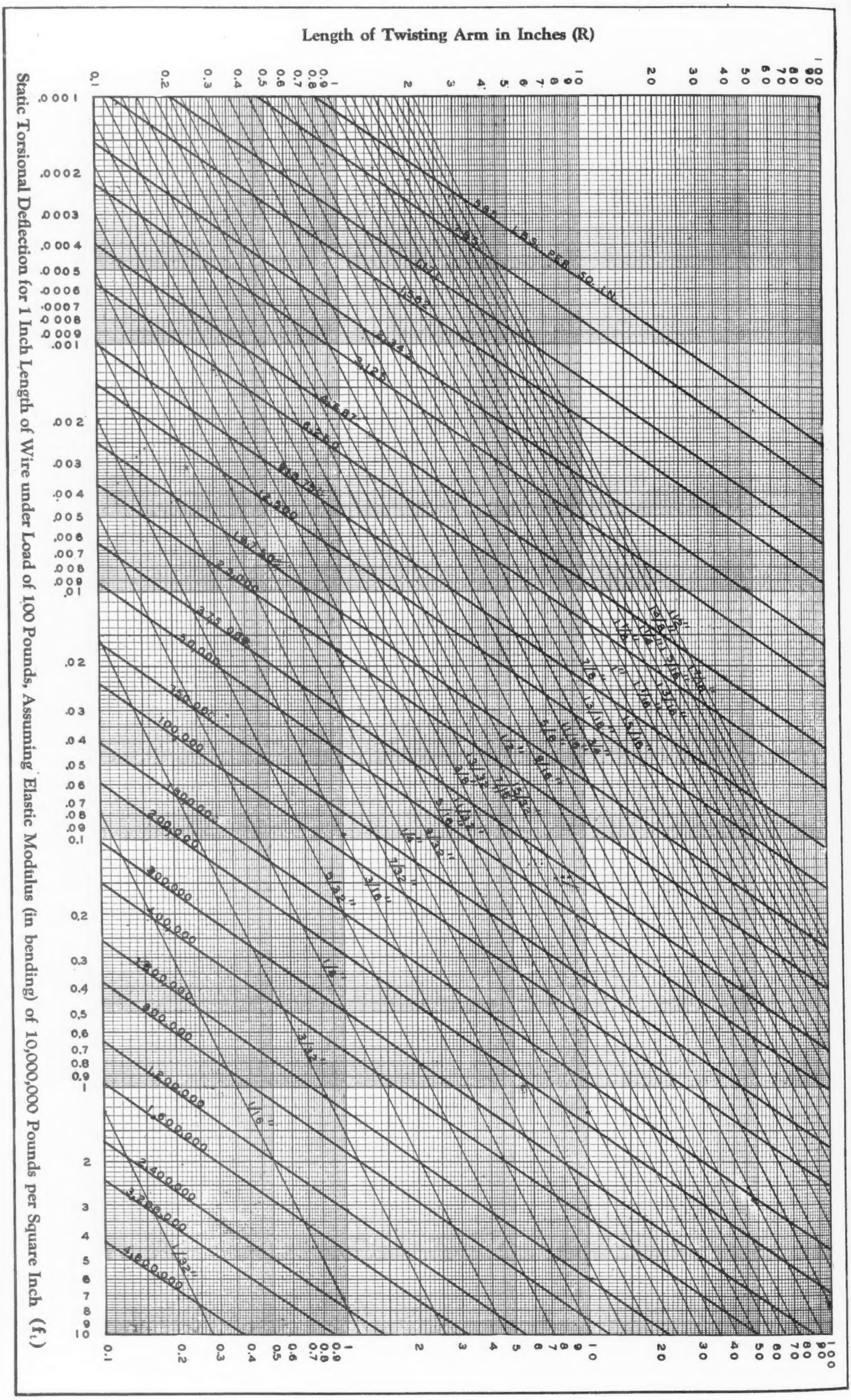


Fig. 2. Chart for Determining Static Deflection of Torsional Springs Made of Square Wire

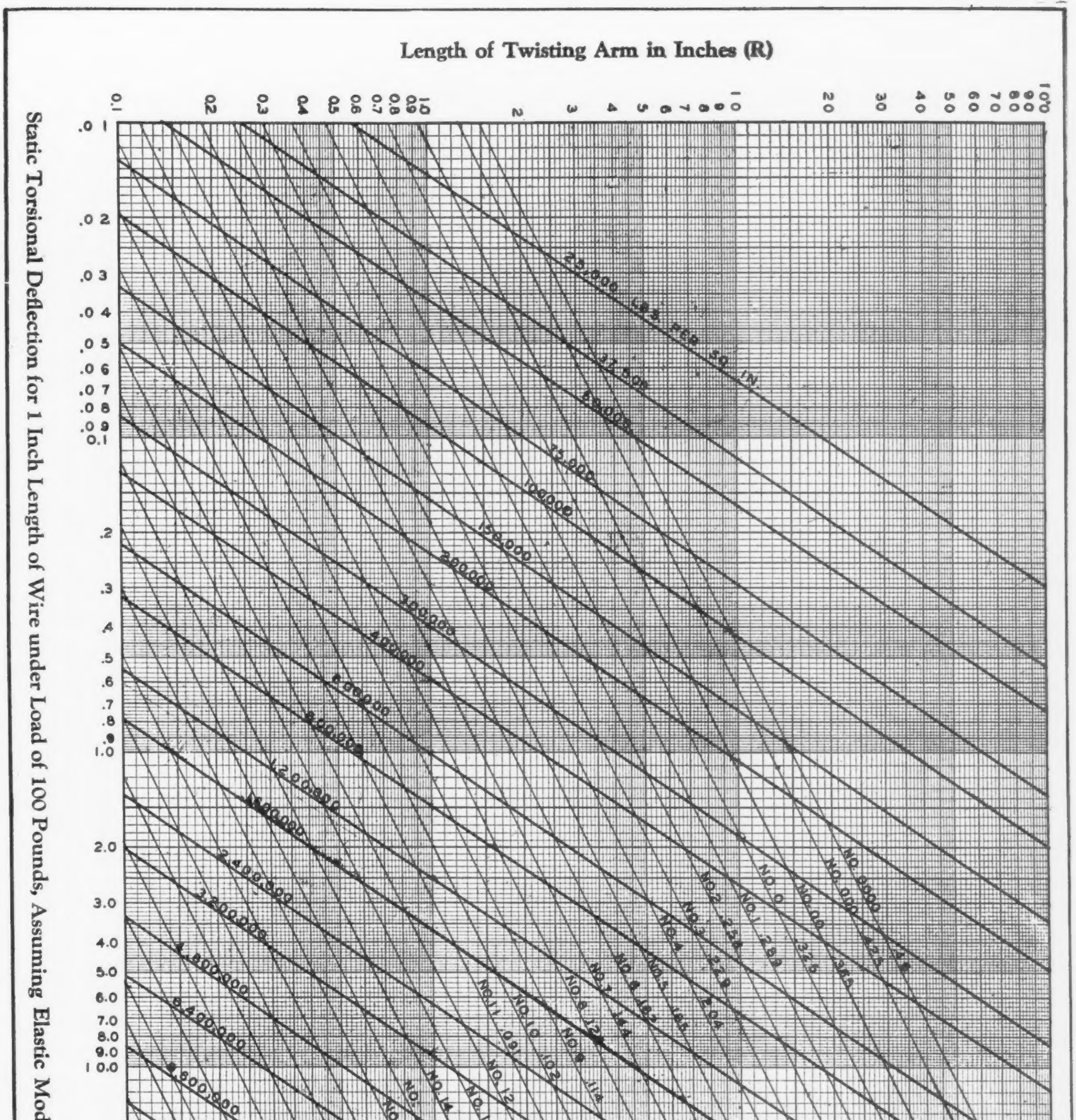


Fig. 3. Chart for Determining Static Deflection of Springs Made of Brown & Sharpe Gage Wire

the diagonal line representing a theoretical fiber stress of 12,800,000 pounds per square inch and the line representing a fiber stress of 19,200,000 pounds per square inch, we may estimate the fiber stress s_t in the spring under a load of 100 pounds to be about 14,500,000 pounds per square inch. Now the fiber stress S_t in the spring is found by the formula:

$$S_t = s_t \times \frac{W}{100}$$

Thus in this case we have,

$$S_t = 14{,}500{,}000 \times \frac{1}{100} = 145{,}000 \text{ pounds per square inch}$$

The total torsional deflection F_t is found as follows:

$$F_t = f_t \times L \times \frac{W}{100} \times \frac{10}{E}; \text{ inserting the values,}$$

$$F_t = 91 \times 30.8 \times \frac{1}{100} \times \frac{10}{28} = 10 \text{ inches}$$

The number of turns made by the twisting arm equals:

$$\frac{10}{2\pi R} = \frac{10}{2 \times 3.1416 \times 1.5} = 1.05 \text{ turns}$$

Example 3—A torsional spring has an outside diameter of 1 1/2 inches, is coiled from No. 20 Washburn & Moen gage wire, and has forty complete coils. The length of the twisting arm is 1 inch. Assuming the modulus of elasticity in tension, E, to be 28 millions, find the fiber stress and also find how many turns the twisting arm will make without exceeding the elastic limit, assuming this to be 120,000 pounds per square inch.

Since the outside diameter is 1 1/2 inches, the mean diameter $D = 1.5 - 0.035 = 1.465$ inches. The total length L of the wire, exclusive of that going to make up the twisting arm $= 3.1416 \times 1.47 \times 40 = 185$ inches. Now, referring to Fig. 1, we find that the horizontal line representing a length of the twisting arm R of 1 inch intersects the oblique line representing the No. 20 Washburn & Moen gage wire on the vertical line representing a static torsional deflection of 134 inches for a 1-inch length of wire.

The point of intersection of the horizontal and vertical lines just referred to is located between the oblique lines representing theoretical fiber stresses of 19,200,000 and 25,600,000 pounds per square inch, and at a distance from the latter line estimated to represent a fiber stress of approximately 24,000,000 pounds per square inch. Now as this value represents the fiber stress under a load of 100 pounds we have, with a fiber stress of 120,000 pounds per square inch, a corresponding load of 0.5 pound.

The total deflection is

$$F_t = 134 \times 185 \times \frac{0.5}{100} \times \frac{10}{28} = 44.3 \text{ inches}$$

The number of turns that the twisting arm can make without exceeding the elastic limit equals

$$\frac{44.3}{2\pi R} = \frac{44.3}{6.28} = 7.05 \text{ turns}$$

[This is the last of a series of five articles on spring design.]

* * *

NATIONAL DIE AND SPECIAL TOOL BUILDERS ASSOCIATION

A few progressive die shops and tool builders in Chicago joined a few years ago in forming an association to promote their common business interests. The association, which has grown rapidly during the last three years and has now been organized along national lines is known as the National Die and Special Tool Builders Association. It is the purpose of this organization to promote the business interests of the job shop and special tool builder, to standardize methods and cost accounting, and to establish a code of business ethics in the industry.

At present, the association is engaged in a program covering the following four divisions: To prove to the manufacturer of metal products that the die and tool shops that specialize on work of this kind can produce tools and special machinery cheaper and quicker than the manufacturer's own tool-room; to make generally known the standards that have been adopted for different classes of dies and other special tools; to put into general use in the die and tool industry a uniform cost accounting system, so that correct estimates and bids may be submitted; and to advocate the adoption of trade practices that will be equally fair to the jobbing shop and to its customers.

* * *

A PUZZLING EXPERIENCE WITH A STEP BEARING

By ARTHUR F. PARKER

In reading the article entitled "A Puzzling Experience With a Step Bearing" in March MACHINERY, page 529, the writer was particularly interested in the statement that the broken piece of the bearing cup was not attracted by the long bar magnet, although the metal was extremely hard and could not be scratched with a file. The assumption that the cup was not made of steel failed to take into consideration the fact that manganese steel is both non-magnetic and extremely hard. The writer believes that the metal which was so mystifying was nothing more nor less than manganese steel.

Many engineers and mechanics may not be aware of the fact that manganese steel is non-magnetic, and on several occasions the writer has witnessed some rather amusing instances when efforts were made to hold this material on magnetic chucks.

* * *

A car that costs $1000 in Detroit, costs about $1940 in Italy, $2020 in Poland, $1975 in Australia, $1660 in Brazil, $1830 in Japan, $1560 in India, and $1600 in Germany, according to George F. Bauer in *Automotive Industries*. This increase in price is due mostly to the high duty imposed by these countries, the ocean freight being the next largest item.

What MACHINERY'S Readers Think

Brief Contributions of General Interest in the Mechanical Field

EMPLOYES' PARKING SPACE

Owing to the ever tightening traffic regulations, which prevent parking of automobiles for a great length of time on the street, many employes who drive their cars to work are faced daily with the problem of finding parking space. The writer suggests that the manufacturer, in order to cope with this problem, provide sufficient sheltered parking space, preferably adjacent to the factory, and charge the employe a reasonable rental for this service. The storage of the cars should be so arranged as to permit parking or removing the car without confusion. It would be a good idea for new plants to provide facilities for parking workmen's cars as part of the original plant design.

G. C. MARTINSEN

AVOIDING MISTAKES IN HIRING MEN

The larger shops today have employment offices that hire all classes of help. This practice has its advantages, but it often brings about a condition whereby a man unsuitable for the work is "wished" on the shop foreman. One company has solved this difficulty in the following manner:

After the employment office has obtained all the required information from the applicant and decided that he is likely to be suitable for the work, the information and the applicant are sent to the head of the department in which he is to work. The foreman then interviews him in regard to his qualifications for the work, and in some instances actually tests his ability. For example, if the applicant should be applying for work as a welder, the foreman gives him a small job of welding to do. In the drafting-room, some simple problem may also be given the applicant to test his ability. This method gives the department head an idea of whether the applicant fits the job or not. It is also easier to estimate the rate of pay that the applicant should be offered.

MORTON SCHWAM

BENCH DESIGNING

The term "bench designing" has been somewhat derisively applied to work occasionally encountered in most machine shops. Many engineers can see nothing to recommend in a system, or lack of system, that prompts a foreman to turn over to an ingenious mechanic, a more or less intricate job which has not been previously worked out on a drawing-board. After telling the workman what is wanted, the usual injunction is, "Go ahead and make something that will work."

In coming to the defense of this practice, the writer must admit at once that mechanics who are competent to handle work of this kind are comparatively rare, but it is safe to say that there is one in every dozen, and an effort should be made to discover and encourage him. Many a struggling jobbing shop has successfully handled rush work by turning it over to the "ingenious mechanic." Often such jobs could not possibly have been handled had the shop been compelled to wait for the drafting-room to develop the design and make working drawings.

The fact of the matter is, mechanics of the type in question are born geniuses, who would rather do work of this kind than have a raise in pay. They are an asset to any shop, and should be encouraged in their work.

H. R. HAGEMAN

IS WASTE SAVING BECOMING A FAD?

Some protests are heard against the many investigations into waste problems by associations and government departments, on the ground that they are wasting more effort than the resulting savings warrant. This was to be expected for two reasons: One is that good ideas are often carried to such extremes as to bring reaction; and the other, that there are always some who object even to the best ideas, if they are new.

Experienced men in the machinery field often show a lack of interest in waste-saving schemes, because they have learned through experience that, too often, efforts to save and utilize waste result in an expenditure of time and money in excess of the value of the waste saved. They realize that this is not good business, and for that reason they are not easily enthused over theoretical ideas of saving waste.

Waste saving and waste utilization are commendable subjects that should have thorough attention. However, we should not lose sight of the fact that waste saving must yield a profit and not prove an expense.

HARRY KAUFMAN

ONE WAY OF MEETING UNFAIR COMPETITION

A great deal has been said about the unfairness of a concern that invites bids with complete plans for special machinery and then, after rejecting the submitted bids, uses the best design or a composite design to invite new bids, with the result that some machine builder who has had no costs for engineering work naturally becomes the lowest bidder and gets the business.

This is how one machine builder handled such a situation; the story seems too good to keep. He was invited to submit a bid with complete drawings to a concern known for its "sharp" buying methods. His bid was about $15,000, but he lost the contract because the firm was able to get some other shop to build the equipment for $13,000 from the original bidder's design.

In this instance, the machine builder who lost the business was not particularly disturbed, because he had anticipated just such tactics and the design that he had submitted with his bid was not his best, but only his next to best, idea. He had in mind another design that could have cut the buyer's costs $25,000 a year, but he held this back until he saw whether or not he would meet with fair play. As a result, in order to make a saving of $2000 on the initial cost, the buyer passed up an annual saving of $25,000 on production costs; but still worse, the machine builder later sold the improved design to a competitor of the first buyer at a fair and reasonable price, and now the first concern is wondering why the competitor is able to under-sell it.

A few such practical demonstrations of the folly of unfair purchasing may help those who are still favoring such methods to see the shortsightedness of their tactics. WILLIAM J. KANE

KEEPING ON IMPROVING THE PRODUCT

In every manufacturing plant making a regular product for sale, there should be someone sufficiently free from routine duties who can give most of his time to devising improvements in the product, so that the company may always be prepared to make changes at the proper time, to keep the product up to date, and to meet competition. Evidently the proper time to make changes is not when the shop is crowded with heavy business, nor is there any reason for making changes when the current design serves its purpose without serious competition. It is good economic policy to adhere to established standards as long as the market permits, unless the new standards mean decided advantages to all concerned.

All criticisms of the product that may be received by the manufacturer should be referred to the man in charge of improvements, and he should have an opportunity to discuss the product frequently with the company's representatives and salesmen, as well as with the factory executives who would be affected by changes in design.

In many manufacturing establishments, this matter of changes is not handled systematically. On the one hand, slight alterations of no decided selling advantage may cause loss of stock on hand, delays in manufacture, and increased costs. On the other hand, a lack of foresight in anticipating needed changes may result in serious losses.

C. GREENSTEIN

COULD TOOL STEELS BE STANDARDIZED?

In most things that we buy, our choice is determined by three factors: The range of prices; the different types, models, or styles in which the article is made; and the service or performance expected from it. When it comes to the buying of tool steel, the price range is very narrow, and price is, therefore, not of great consequence; type or style does not enter into the decision; and, hence, the selection must be determined solely by the performance of the steel. This would seem to make the choice comparatively easy, but, as a matter of fact, it does not.

A recent survey shows that there are almost 700 brands of tool steel marketed in the United States by more than sixty manufacturers. There are over 200 brands of carbon tool steels, many of them differing very little in carbon content. There are over 300 brands of alloy tool steels, varying slightly in composition, and there are almost 100 high-speed steels. Considering the sizes and shapes of these different brands that must be carried in stock to meet the requirements of customers, it is evident that an enormous tonnage of tool steel must be carried in the warehouses of the steel manufacturers and their distributors. Have not many of these brands been introduced to obtain a competitor's business rather than to fill any well defined needs?

The uses for which the various brands of tool steels are recommended are not clearly defined by the steel manufacturers. Instead of several more or less single-purpose steels, we find many multi-purpose steels, which are supposed to perform efficiently a long list of operations. For any specific purpose, the purchaser has a choice of a number of brands, and as far as the information furnished to him by the steel maker is concerned, he may expect equally good results from any of them. This seems to indicate that the number of brands is greatly in excess of the needs of the industry. The fact that two different plants may buy two different brands of tool steel made by the same steel maker, but used for the same purpose, with apparently equally good results, indicates that at least one of these brands is superfluous.

I know that competition is necessary and valuable, but at the same time it may be the cause of serious waste. When one steel manufacturer produces a steel of a certain analysis, practically every other steel manufacturer is forced to produce a similar brand of steel, although a steel suitable for the purposes for which it is to be used may already be made by them. The result is confusion to the purchaser and increased manufacturing and distributing expense to the steel manufacturer.

It seems to the writer that the metal-working industries would be greatly benefited if there could be some kind of standardization of tool steels, each brand being sold to fill certain well defined needs.

R. H. KASPER

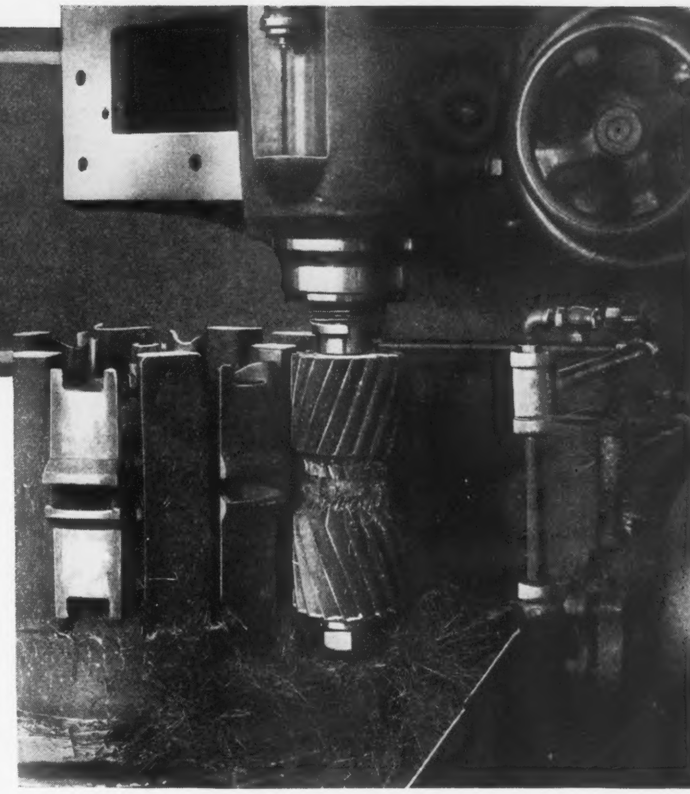
IMPORTANCE OF KEEPING TOOLS SHARP

Probably every workman has been told at one time or another to see that his tools are kept properly sharpened. Nevertheless, there are generally a few men in every plant who do not fully realize the importance of this, and who do not know that it is a matter of as much concern to the president of the company as to the foreman who is directly responsible for production.

The importance of keeping tools in first-class condition should be emphatically impressed on the mind of every workman. Perhaps discussions or articles in the shop paper, bulletin board suggestions, lectures, and personal urging may be combined to help bring about the desirable condition where every tool is kept in perfect shape and is, therefore, operating at its maximum efficiency.

G. H. GUNN

Milling Cutter Engineering



Examples of Milling Cutters Especially Designed to Meet Requirements of Different Jobs

By A. N. GODDARD, President
Goddard & Goddard Co., Inc.

TO one who loves mechanics, the unusual in machining methods is always fascinating. I do not mean by this mere freak methods of solving a machining problem, but rather the efficient solution that necessitates departure from the beaten path of procedure.

Perhaps the writer might have been a more successful business man had he not yielded quite so much to the lure of the difficult jobs in his chosen field of effort—milling cutters. There might have been a few more dollars in his coffer had he confined his efforts to mass production of standard cutters, but the joy of achieving would have been very much less. At any rate, he has given the best years of his life to what he is pleased to call "milling cutter engineering."

Those who have materially contributed to the development of the milling machines of today are certainly worthy to be called engineers; but without in any sense detracting from their glory, the milling machine is, in the last analysis, but the holder for the work and the driver for the cutter that finishes the surfaces of the work. And the design of the most efficient type of cutter is certainly also worthy to be classed as an engineering accomplishment.

If the following illustrations and descriptions, selected from an almost endless number of special cutters developed to meet unusual requirements efficiently, arouse interest in others, so that they will give this subject study, or perhaps spur them to investigations as to whether their present methods of milling are as efficient as they could be, this article will have served a useful purpose.

Cutters for Milling Two Splines at a Time

Quantity production of splined shafts is almost universally accomplished by hobbing, but the repair shop that must produce many different splined shafts in the course of a year, and only one or a few of one kind, finds hobbing out of the question. Fig. 3 shows two formed milling cutters of special design which were produced for such service. They cost much less than a hob and, also, perform the job in one-half the time that would be required with a single standard spline cutter, since two splines are milled simultaneously. These cutters are so designed that the required accuracy of the root diameter and thickness of the splines is obtained throughout the entire life of the cutters, regardless of the number of resharpenings that may be required.

Gang Cutters with Internal Driving Lugs

Fig. 1 illustrates four gang cutters designed for simultaneously milling the forked end of front wheel-spindles for a five-ton truck. These parts are heat-treated alloy steel forgings. The only machine available for the operation was a No. 4 knee-type miller; the bushings in the pendant arms could not take arbors larger than 2 inches in diameter. Arbors of this size would not withstand the torsional and bending stresses developed in taking the heavy cuts, and this led to the designing of the cutters shown.

Outside cutters, 15 inches in diameter, were required, these cutters just clearing the pendant arms. The necessary space between the inside faces of these cutters was about 10 inches. The use of arbor collars in excess of 2 5/8 inches in diameter was prohibited.

This milling problem was solved by forging, from chrome-nickel steel, a solid arbor 2 inches in diameter at the front end to suit the bushing of the pendant arm, but having a diameter equal to the outside diameter of the collars for a 2-inch arbor, for the remainder of the length. Interrupted flanges or lugs were forged at the three positions of the cutters. The cutter bodies were milled with internal driving lugs, the inner ends of which were machined to seat on the arbor, so as to give the set-up maximum rigidity. The cutters were bolted to the lugs on the arbor, and the latter served as driving keys, no keyway being milled in the arbor.

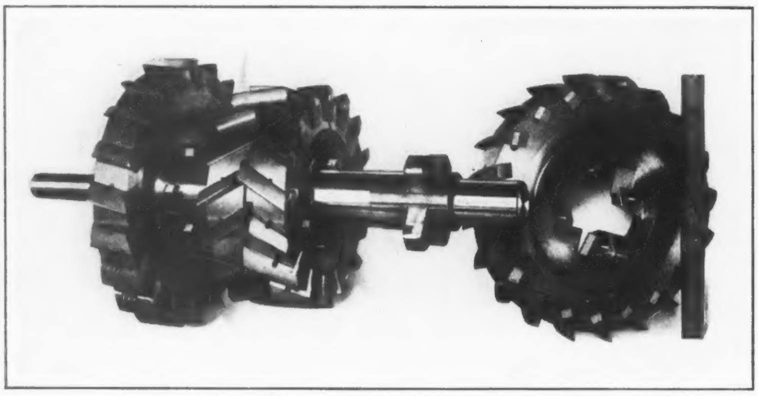


Fig. 1. Milling Cutters and Arbor Constructed for Performing a Heavy Operation on a Comparatively Light Machine

With this construction, the over-size job was so successfully handled in the under-size machine that several other machines were later equipped in the same way.

Two-section Stepped Angular Cutter

A two-section stepped angular cutter designed for simultaneously milling two angular surfaces and a narrow shoulder between, on steel safe doors and vestibules, is shown in Figs. 2 and 4. This cutter is carried on a heavy flanged stub arbor provided with a taper shank. At the large end, the cutter diameter is 10 inches. Both sections of the cutter are tapered to an included angle of 28 degrees, and the total length of cut is 9 1/2 inches.

In Fig. 4 this cutter is shown taking a full length roughing cut, during which about 3/8 inch of stock is removed at a feed of 2 inches per minute. The feed for finishing cuts is about 2 3/4 inches per minute, and the depth of cut, 1/16 inch. The material machined is a good grade steel casting.

It will be observed that the upper or larger section of the cutter has a right-hand spiral. It takes a clean shearing cut with both the peripheral and the end teeth, the latter cutting the step or shoulder between the angular surfaces. The lower section of the cutter has a spiral of opposite hand, thus neutralizing the thrust of the upper cutter and insuring a steady, free cutting operation. No cut is taken by the end of the lower cutter section.

Cutter Unsupported at One End which Mills to a Length of Seventeen Inches

Assembled and detailed views are presented in Figs. 5 and 6, respectively, of a heavy type helical

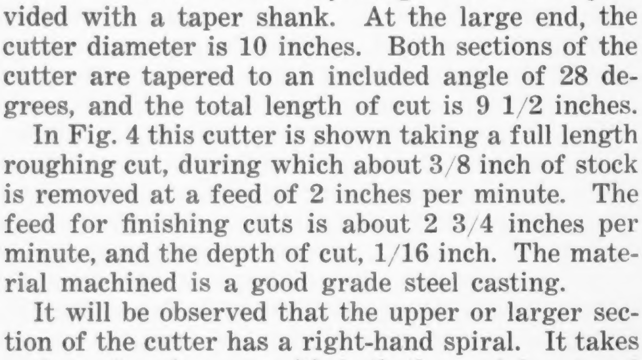


Fig. 2. Cutter Used for Milling Two Angular Surfaces and a Narrow Shoulder Between, at One Time

cutter designed for use in deep die-sinking operations where no support of the outer end is possible, notwithstanding the fact that the cutter must mill for a length of 17 inches, not only with the periphery but also with the end teeth. The unusual construction was developed to provide the necessary rigidity in making automobile body dies. The cutter is 3 3/4 inches in diameter and is used on a heavy Newton planer type milling machine. It is made of high-speed steel and has an integral flange, as may be seen at *A* in the detailed view Fig. 6.

In assembling the various parts of this cutter to the spindle of the machine, taper plug *B* is first inserted into the spindle nose, and then plate *C*, which centers on plug *B*, is fastened to the spindle nose by means of machine screws. Slots on the back of this plate are located over keys

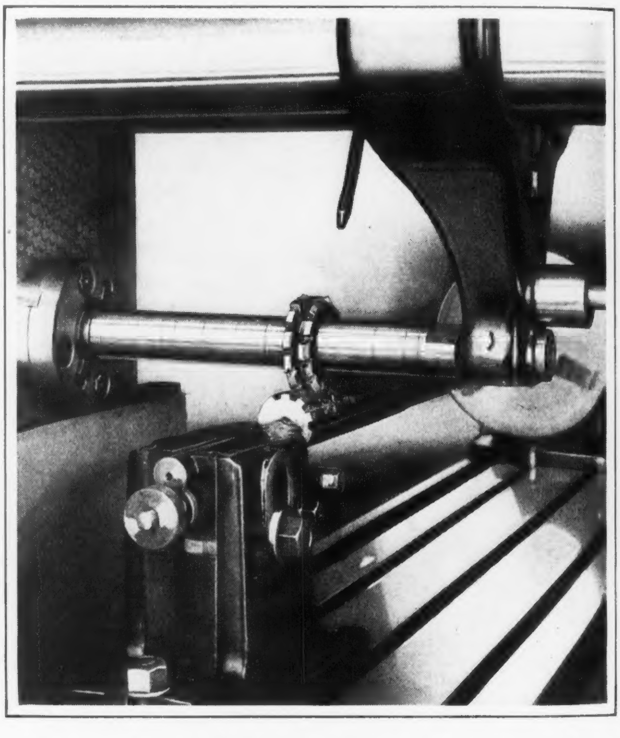


Fig. 3. Formed Cutters Designed for Simultaneously Milling Two Grooves in Splined Shafts

on the nose. Cutter *A* is then placed against plate *C*, with two slots of the flange seated over the keys of the plate, and with a ground blind hole in the flange centering the cutter on the small ground extension at the front end of plug *B*. Nut *D* is finally slipped over the cutter and screwed on the threads on the outside of plate *C* to hold the entire cutting unit together. Hollow-head set-screws are employed to lock the nut in place.

In driving this tool, power is transmitted direct from the spindle nose of the machine to plate *C* through keys, and thence to the cutter flange by two additional keys. Rigidity in cutting is obtained because of the wide flange.

Large Spot-facing Cutter with Inserted Blades

The tool illustrated in Fig. 7 is 10 inches in diameter and is used to spot-face a flange surface on pressed-steel automobile rear axle housings against

which the cover plate fits. This cutter has inserted blades which are inclined at an angle of 20 degrees so as to obtain a steep rake. The cutter body is bolted to a flange on the arbor, and the arbor has a taper shank at one end which is inserted in the spindle of a heavy drilling machine for the operation. At the front end, the arbor is equipped with a roller bushing which enters a stationary bushing in the jig and serves as a pilot. Two small holes may be seen adjacent to each cutter blade. These carry lubricant from the upper side of the cutter body, which is kept constantly flooded, to the cutting edges of the blades.

Rigid Built-up Cutter Designed for Severe Service

Fig. 8 shows a close-up view of an interesting job performed on a Cincinnati No. 5 plain milling machine equipped with a specially built cutter-head. The work consists of milling three notched

Fig. 4. Opposed-spiral Cutter Unit Illustrated in Fig. 2, in Operation

surfaces on heavy steel castings. These castings are held in a fixture designed to enable the successive notches to be conveniently indexed into position for machining. After the notches have been indexed into line with the cutter, the transverse feed is engaged to feed the work toward the column; thus the three surfaces are finished at one pass.

The ruggedness of the cutter used in this operation is apparent from the illustration. The lower cutter section is 9 1/4 inches in diameter and 5 inches long, while the upper section is 11 1/2 inches in diameter at the large end and 2 1/4 inches wide. About 90 per cent of the total cutting edge engages the work, the total length of cut being approximately 15 inches.

This job necessitated an overhung construction of the cutter and its head, which made rigidity a difficult problem. However, by constructing the cutter as illustrated by the detail views in Fig. 9,

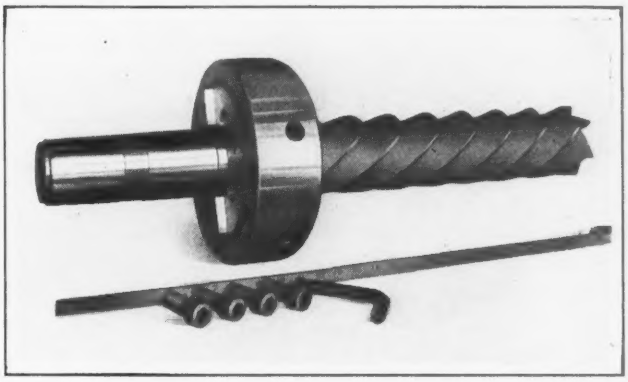


Fig. 5. Cutter which Mills for a Length of Seventeen Inches with the Periphery and the End Teeth

the problem was solved in an entirely satisfactory manner.

Opposed-spiral Gang Cutter for Continuous Operation

Four helical tooth cutters, grouped together on a 2-inch stub arbor which is held in a pendant position, without bottom support, on a Becker vertical milling machine, are shown in the heading illustration. The operation consists of milling the lock-joint on the felloe end of spokes for a built-up wheel used on five-ton trucks. These felloe ends are malleable-iron castings, and the job is performed at the plant of the Erie Malleable Iron Co., Erie, Pa. The milling machine is equipped with a circular fixture which carries a double set-up of spokes in the same position relative to each other as they occupy when assembled in the finished wheel. This practice insures a true fit on the rounded spoke ends.

The long cutters of this installation are 5 inches in diameter, and the over-all length of the four cutters is about 11 inches. There is an actual lineal contact between the cutter and work of 9 3/8 inches. The peripheral speed of the large cutters is approximately 70 feet per minute, and the work is rotated past the cutters at a speed of 21 inches per minute. About 3/16 inch of stock is removed in a single cut, which leaves a smooth finish.

An average of 15,775 cubic inches of stock has been removed by these cutters per grind. Aside

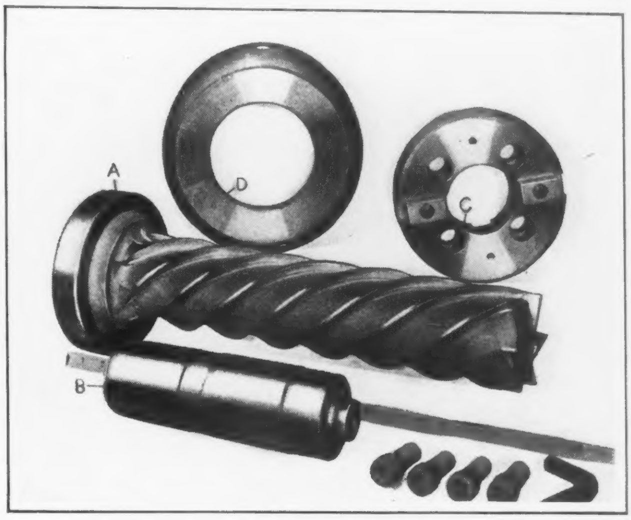


Fig. 6. Disassembled Details of the Long Helical Milling Cutter Illustrated in Fig. 5

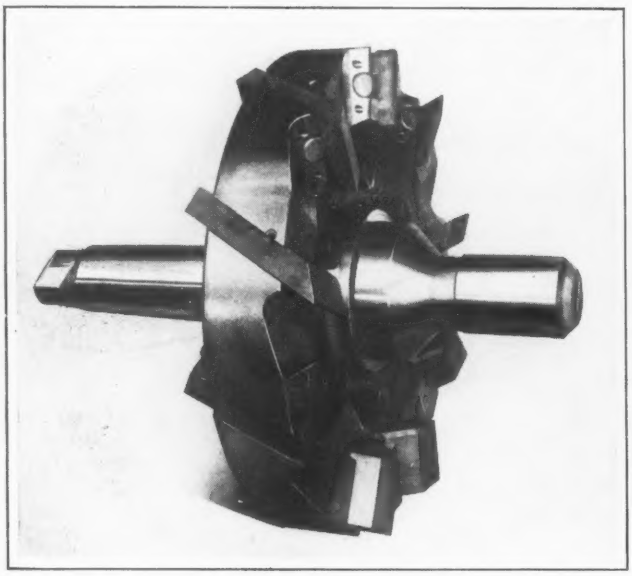


Fig. 7. Spot-facing Tool Ten Inches in Diameter, Used in an Operation on Automobile Rear Axle Housings

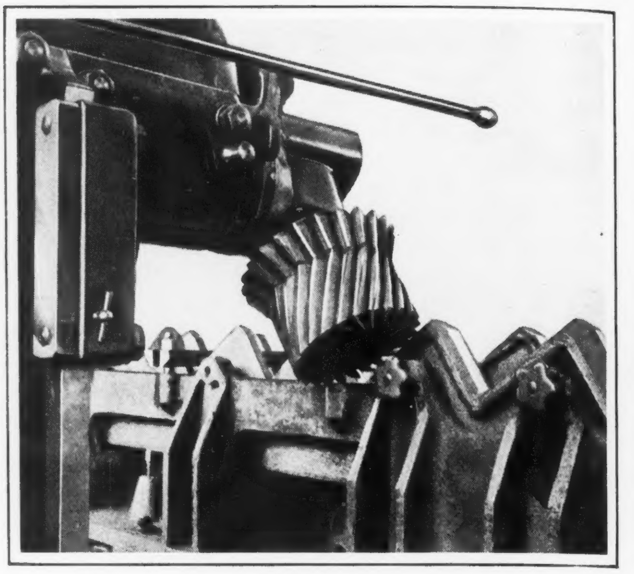


Fig. 8. Special Cutter Designed for Simultaneously Milling Three Surfaces on Notched Castings

from the free cutting action of the cutters, which is due to the shearing cut taken, and to the steep opposed-tooth spirals which neutralize the thrust of the cut, much of the success of this job is attributable to the rigidity of the set-up and the abundance of power supplied for driving the cutters.

* * *

WIDER PULLEYS AND BELTS ARE REQUIRED BY LINE-START MOTORS

According to J. R. Hopkins of the Chicago Belting Co., Chicago, Ill., it is estimated that about 15 per cent of all new motors now made for industrial applications are "line-start" motors. It is further estimated that five years from now 70 per cent of all new motors for industrial application will be of this type.

Line-start or across-the-line motors are those that are made in such a way that they start across the line in accordance with the rulings of the National Electric Light Association. In line-start motors the current goes directly to the motor—it is not regulated through a compensator, as in the case of ordinary standard motors. The operator cannot control the load on the belt when starting, and as the motors come from rest to full load quickly, they have a high starting torque and higher overload at the shaft than standard motors.

In spite of this higher starting load, most of the line-start motors are provided with the same pulley widths as standard motors. The effect of the starting load on the belt has been underestimated. It has been said that the higher starting load is only momentary and not sufficient to affect the belt, but men experienced with belting know what happens to a leather belt that is repeatedly required to carry a 200 or 300 per cent overload.

In actual shop practice, it has been found that when line-start motors are started, the pulley will spin around inside the belt and, instead of this being but a momentary spinning of just a second or two duration, it will frequently continue for from 30 seconds to 3 minutes. This will either drive the belt off the pulley, so that the motor has to be stopped in order to put the belt on again, or the belt will be burned. This trouble is not confined to belts only. The higher starting loads of line-start motors have stripped the teeth off chain sprockets. At a meeting of electrical maintenance engineers recently held in Chicago, which was attended by about 140 maintenance engineers of the largest plants in that city, it was generally agreed that wider pulleys and belts were needed for line-start motors.

Mr. Hopkins further states that normal load line-start motors require a pulley and belt from 20 to 25 per cent wider than those used with a standard motor. So-called high-torque line-start motors should have pulleys 50 per cent wider than for standard motors. Where at present line-start motors are giving trouble, it is advised that, if possible, a heavier belt be used and the speed increased by increasing the diameter of the pulley. If that does not obviate the trouble, it is advisable to increase the pulley diameter and also increase the pulley width by about 20 per cent.

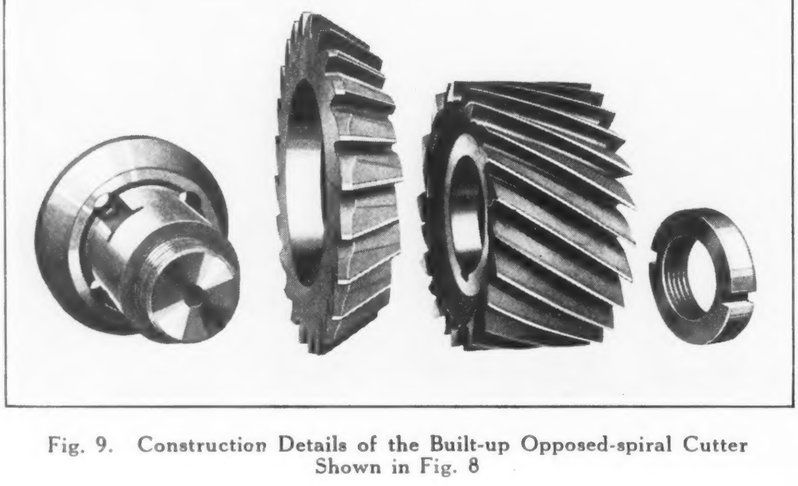


Fig. 9. Construction Details of the Built-up Opposed-spiral Cutter Shown in Fig. 8

Intelligent Planning Reduces Tooling Costs

Supervision of Tool Designing and Tool-room Operation, to be Successful, Must be Based on a Thorough Study of the Principles Involved

By F. J. SANDERS, Tool Supervisor, Ohmer Fare Register Co., Dayton, Ohio

THREE fundamental points should be considered in tooling a product: First, the necessary degree of accuracy and interchangeability of the parts to be made; second, the number of parts required; and third, the maximum amount of money to be spent for tools. The first two fundamentals control the third entirely, and therefore too much attention cannot be paid to these points, if the cost of tooling is to be kept down to the minimum.

The limits of accuracy and interchangeability are decided by the engineering department, and it is in this department that the first possible savings in connection with a tooling program must be looked for. For obvious reasons, the largest tolerances consistent with the proper functioning of parts should be specified.

Cooperation Essential Between Engineering and Tool Departments

Close coordination between the tool and engineering departments is desirable; otherwise, tool costs are certain to be high. There should be a connecting link between the two departments to see that the product is designed not only from the point of view of making it function properly, but also of lowering tool costs. This connecting link may be a tool engineer or a checker who has a thorough knowledge of tools, and his suggestions should be given utmost consideration.

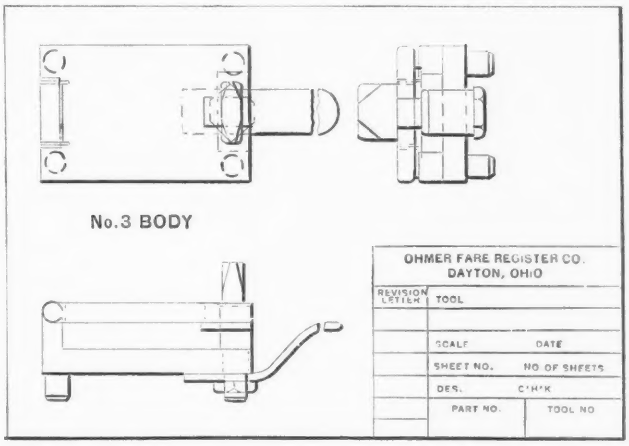


Fig. 1. Standard-Part Drawing on Which Details can be Added to Suit Individual Jobs

Tool Expenditures Should Depend upon the Quantity of Parts to be Produced

In considering the second fundamental point in tooling a product, it is, of course, important to remember that the tooling for 500 parts should be much simpler in construction than tools for 500,000 parts, and that the most economical procedure would be to construct temporary tools for the smaller amount. Temporary tools cost only a fraction of the cost of permanent tools, but at the same time they usually increase production costs. When the saving in tool costs is less than the loss in production costs, it is no longer good practice to make temporary tools. Also, it is more economical to provide expensive tools when a large number of parts are to be produced and the saving in production costs will exceed the increased tool costs.

It can readily be seen that the management must decide just how much of a market there is for the new product, and determine upon a minimum amount of production. This information must be supplied to the tool engineer before he can estimate the amount of money required to build the tools. In order to limit the cost and prepare a fairly accurate estimate, the tool engineer must study the various engineering prints and obtain a fair idea of the design of the tools that he is planning to build. Estimates must be carefully arrived at in order to be effective, since the workmen will cease to regard the estimated times for various operations if they are too high or too low. If a reasonable estimate is placed on a job, the workmen are likely to make it in less than the estimated time.

With a definite amount of money appropriated and approved by the superintendent or works manager, the tool engineer must design and construct the tools within this sum. Before any actual work is begun, at least two models of the product should usually be made and given a thorough trial in order to prove out the drawings, as it is costly to make changes in the product after the tooling has been completed.

Standardization of Tool Details Reduces Designing and Toolmaking Costs

The cost of any tool depends largely upon its design, and hence efficiency in the tool designing department will pay big dividends. The old method of building jig bodies by screwing and doweling a number of pieces of steel together is wasteful, and, therefore, the designer of today orders a cast-iron body. With tools for smaller types of work, such as parts of adding machines, typewriters, and cash registers, it is possible to standardize many tools so that they can be made in the tool-room in comparatively large quantities at appreciably reduced costs. Among such standardized tools may be listed jig bodies, die sets, screw-machine cam blanks, rivet plates, stripper plates, stripper guide pins, stripper guide-pin bushings, stripper springs, dowels, fixture screws, knock-outs, handles for shaving die-nests, six-foot lengths of planed stock for die-blocks, and punch-holders.

In the organization with which the writer is connected, three different sizes of jig bodies are kept in stock, and for each size the tool design department has a quantity of drawings, such as shown

DATE ISSUED 1-21-29 DATE DUE 3-1-29 TOOL NO. T-50671
DATE FINISHED APPROVED BY F.J.S. PART NO. X-2251

DESCRIPTION

Make one compound blank and pierce die, to pierce all holes and make blank complete.

WHITE BOND—TOOL SUPPLY
PINK BOND—PRODUCTION
BLUE BOND—FOREMAN OFFICE
WHITE CARD—TRAVELER CARD
BUFF CARD—COST DEPT.

EST. TIME
100 HRS.
CHECKED BY
DF

DELIVERED TO #3

ORDER ON TOOLMAKING DEPT.

JOHN SMITH
WORKMAN

Form 854 Ohmer Fare Rand Kardex 312-B550

Fig. 2. Form Which Facilitates the Ordering of Tool-room Work

in Fig. 1, which are printed on vellum paper. Upon the receipt of an order for a drill jig, the tool designing department merely selects the proper size of jig body, fills in the necessary clamping device on a printed drawing of this part, provides dimensions for the location and size of holes, etc., to be produced, and the drawing is then ready for the toolmaker. When the blueprint reaches the job foreman, he merely issues a requisition for the jig body, orders the toolmakers to bore the holes, locate the nests, etc., to suit, and the job is completed in about one-fourth the time that would be required to build up the entire tool.

Standardization of tool parts should be one of the chief aims of the tool design department. An encouraging tendency toward this end has resulted from the increasing facilities offered by shops that manufacture standardized die-sets, jig bushings, etc. These shops make it just as easy for small manufacturers to standardize as large ones.

Who Should Order Tools?

Ordering of tools should be done either by a committee consisting of a representative from each of the production, routing, engineering, and tool departments, or by the head of the tool department. In the opinion of the writer, it is more efficient and economical to have one man plan and order all tooling, provided, of course, that he is thoroughly competent and familiar with the practices of the company.

For ordering tools, some standard form should be used on which there is space for writing in the date of issue, the date due, an estimate of the time required for making the tool, and a general description of the tool. The form used for this purpose by the Ohmer Fare Register Co., is shown in Fig. 2. It measures approximately 6 by 4 inches. Five copies of each order are made out, and sent to the tool supply, production, and cost departments and to the tool-room foreman's office. The fifth card is attached to the work. These forms are printed on different colored paper to avoid confusion.

The purpose of these copies is to notify the various departments that the tool has been ordered, to advise the production department when the tool has been finished, and to furnish a record for the use of the cost department. The form that goes to the cost department is slightly different from the others in that space is provided for itemizing material and labor costs. Fig. 3 shows the arrangement of this card. No order card should be closed out until it has been signed by the foreman to indicate that he has checked the time and compared it with the estimate. The figures filled in on the forms Figs. 2 and 3 in this article are not actual figures for a given job, but merely show how the forms are filled in.

Records Should be Kept of Toolmakers' Performance on Previous Jobs

A careful record should be maintained of the time each toolmaker spends on every job. Such a record may be maintained on cards of the type illustrated in Fig. 4, and will provide an accurate check on the ability of each workman. If the man's pay is arranged accordingly, the system will promote his good will and stimulate his ambition. This system has another advantage in that it forces the foreman to check the time on all jobs and brings spoiled work to his attention.

The most efficient tool organization is the one in which the foreman is familiar with every tool being built, and by means of the simple system just explained, this end will be attained. Tool rejections should be recorded against the workman concerned.

How Tool Designing and Making Should be Divided

In most tool organizations there are three distinct classes of work that should be kept divided, if the size of the tool-room force warrants it: First, die work; second, jig and fixture work; and third, small tool work such as taps, reamers, cams, form tools, etc. For each of these work divisions, it is best to employ men who are specialists in that particular class.

Some machinery and equipment is used more for one class of work than for another, and when this is true, the equipment should be grouped or placed so as to be convenient to the men using it most. For instance, vertical milling machines, vertical shapers, and filing machines, which are used more frequently by diemakers than other workmen in the tool-room, should be placed convenient to the benches of the diemakers. A good arrangement is to group together a few machines of different types, such as a lathe, drill press, vertical milling ma-

chine, shaper, etc., throughout the department for every six or seven diemakers or jig and fixture makers. In most large plants, each of the three divisions of work is under the supervision of a job foreman who has complete authority over his particular line of work.

Tool jobs should come to the bench men with all the machine work completed as far as practicable. Dies for a force of ten diemakers can be sawed and filed to size by one man using a modern filing machine. All accurate holes for various tools can be bored by one man; and lathe, milling machine and grinding machine work can be done by others previous to the delivery of the parts to the bench men. Die-sets, stripper screws, dowel-pins, etc., may be kept ahead in the stock-room, ready for the diemakers. With this practice, the work of the diemakers usually amounts to only a little machine work, some finish-filing, fitting, and assembling.

Frequent Calls to the Tool-crib Should be Prohibited

The tool-crib in any tool-room should be situated in the center of the room, if possible, and should be easily accessible from all sides. Bench and machine men should be furnished with a complete set of numbered drills, and bench men should also be given a block containing standard reamers of the sizes used most. Bench lathe collets should be kept in racks near the bench lathes, and cutting- and machine-oil cans should be placed outside the crib, where they may be obtained without delay. The writer mentions these few items because he has found, from his own experience, that these things cause many trips to the tool-crib. It will pay any tool-room foreman to check the activities of his tool-crib, to find out who makes the cost trips and why. No toolmaker can work at maximum speed if he has to stop and run to the tool-crib for everything he needs.

A Few Rules that Promote Efficiency

There are various things that engineering departments should bear in mind, in order to decrease tool-room costs. In the first place, faded or indistinct blueprints should not be issued to the tool-room. If a new tracing is necessary to obtain a good print, the expense is usually justified. The largest tolerances consistent with the proper functioning of the part should always be given, as already mentioned. Intricate forms should be eliminated. Designs relating to sheet-metal parts should be such as to avoid weak projections in the dies, and sharp corners should be eliminated wherever possible. Holes, etc., laid out to angles, should be dimensioned in decimals instead of in degrees, wherever possible, as, otherwise, the toolmaker must make such calculations before he can build the tools, and he is more likely to make errors in mathematics than are engineers.

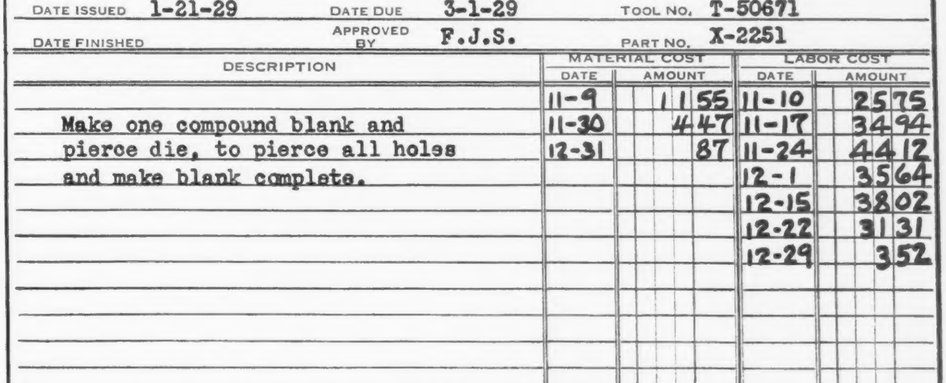
If there is anything in a drawing that may escape the notice of the workman, his attention should be called to it by means of a note. When a number of diversified products are made by a company, it is often possible to use old standard parts in designing a new mechanism. Sometimes a few simple alterations can be made which in no way interfere with the original use of the tool.

All shop drawings should be mounted on cardboard or some other stiff material. This keeps the prints legible, because they are not easily soiled or torn and cannot be folded. Also, the drawings cannot be easily lost, can be filed to better advantage, and are more readily handled by the user. One person should be in charge of the shop drawings and should issue them to the workmen. It is important that records be kept of all the prints issued, in order that old prints may be destroyed when new drawings are brought out.

Upon receiving a notice of a change in design, the engineering department should issue a warning to have work stopped at once on all parts affected. This should automatically cause the old prints to be returned to a separate file, where they may be held until the new drawings arrive or the old ones are released. New prints should be accompanied by a change notice, giving all the information required concerning the changes, and this notice should preferably be filed for future reference. Changes should pass through the hands of someone responsible for withdrawing all the tools affected from the cribs and for issuing necessary orders to change them in accordance with the revised drawings.

Tool Supervisor Should Keep Informed on New Methods

If efficient tool organizations are to be maintained, tool supervisors must keep abreast of the



TOOL COST CARD

DATE ISSUED 1-21-29 DATE DUE 3-1-29 TOOL NO. T-50671

DATE FINISHED APPROVED BY F.J.S. PART NO. X-2251

DESCRIPTION	MATERIAL COST DATE	MATERIAL COST AMOUNT	LABOR COST DATE	LABOR COST AMOUNT
	11-9	11 55	11-10	25 75
Make one compound blank and	11-30	4 47	11-17	34 94
pierce die, to pierce all holes	12-31	87	11-24	44 12
and make blank complete.			12-1	35 64
			12-15	38 02
			12-22	31 31
			12-29	3 52
#3	DF			

COSTED	QUANTITY	UNIT PRICE	AMOUNT		
MATERIAL			16 89		213 30
LABOR			213 30		
BURDEN			511 92		
Form 854 Onmer Fare Rand Kardex 342-B550 TOTAL			742 11		

Fig. 3. Cost Department Copy of an Order on the Tool-room

CHECK NO.	NAME	DATE EMPLOYED	HRS. EST. TIME	HRS. ACTUAL TIME	TOOL RES.	DATE OF LAST INCREASE	AMT.
7001	John Brown	Jan 1st-1927					
PART NO.	TOOL NO.	NAME OF TOOL					
						June 1	5¢
						to 95¢	per hr
75-357	739700-A	Blanking Die	150	140	0		

Fig. 4. Card for Recording the Performance of Toolmakers on Every Job

times concerning the latest developments in machines and methods. Trade journals are the best sources of this information. Today better tools can be built than was possible five years ago, and it follows that any organization is losing money, where the executives do not keep in step with the march of progress.

The tool-room equipment of many plants receives less consideration than the production equipment, because savings in that direction are not so apparent. This is unfortunate from an economical standpoint, because a few years of neglect in this direction will cause a large increase not only in tool expenditures but also in production costs.

* * *

SHAPING RECTANGULAR OPENINGS IN BIG CONNECTING-RODS

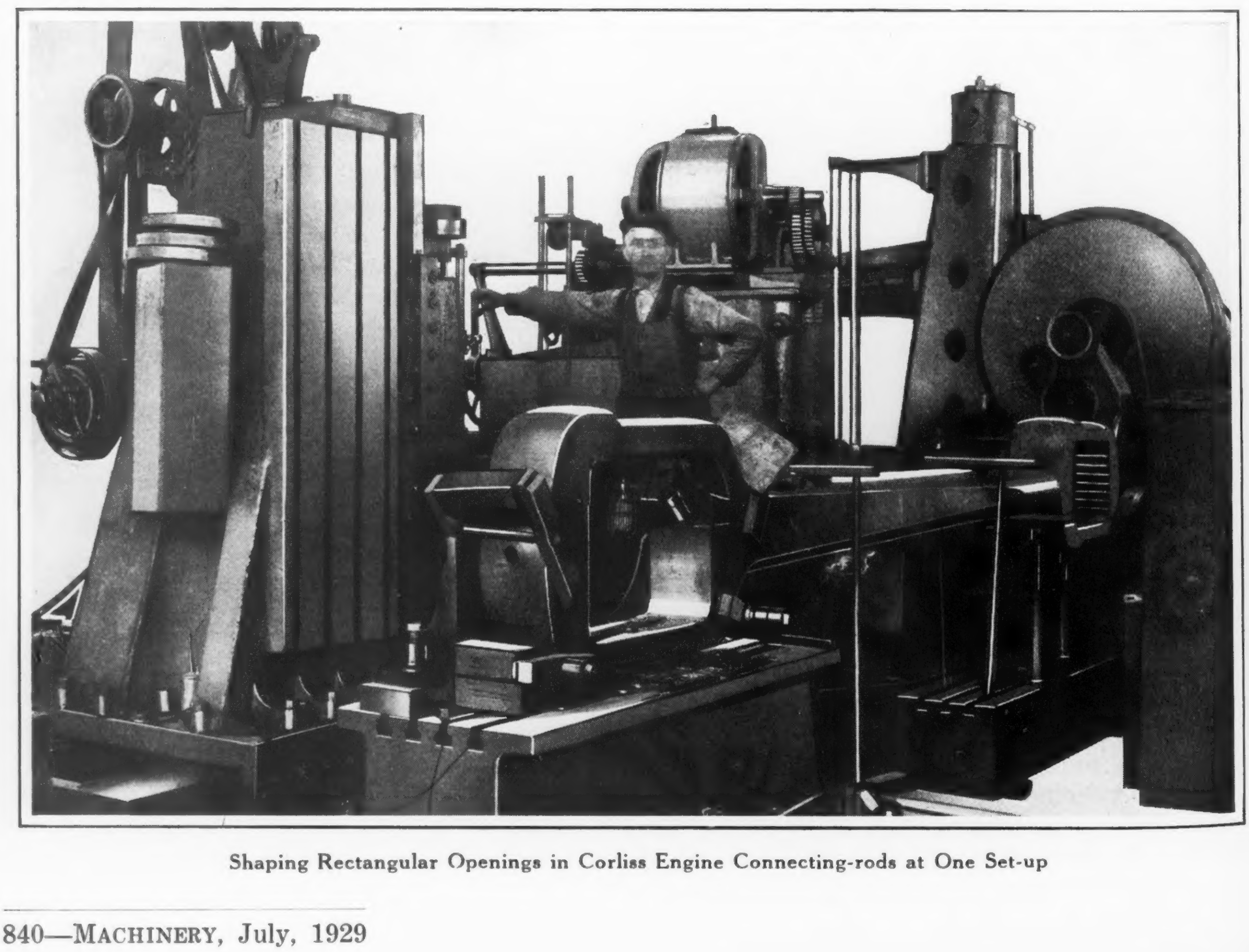
The connecting-rods used in Corliss steam engines built by the Hooven, Owens, Rentschler Co., Hamilton, Ohio, are steel forgings made with the ends solid. These ends must, of course, be later machined out to receive bearing boxes. The first step in producing the openings consists of drilling holes through the solid metal completely around chalked outlines. These holes are spaced closely together so that solid blocks can be taken from the ends as the drilling is completed. How the holes are drilled will be understood by referring to the right-hand end of the big connecting-rod shown in the illustration.

When the blocks of stock have thus been removed, the connecting-rod is placed on a Morton traveling-head draw-cut shaper, as illustrated, and all four sides of both openings are accurately machined to receive the bearing boxes. In machining either opening, the shaper saddle is fed vertically and the column horizontally as required for finishing the sides, bottom, and top of the opening. The tool-head is mounted on a spindle which extends through the center of the shaper ram and permits of swiveling the tool-head to suit the different straight and rounded surfaces.

After the opening in one head has been completed, it is an easy matter to traverse the shaper column along the bed for finishing the opening at the opposite end. Thus both ends are completed at one set-up of the work. The connecting-rod illustrated has a center-to-center distance between the openings of about 20 feet.

* * *

The advantage of supplementing railroad transportation with motor trucks is well illustrated by the fact that seventy steam railroads are using motor trucks for short hauls and terminal service. The total number of motor trucks used in the United States now exceeds 3,200,000. Seventy-two railroads are also operating motor buses.



Shaping Rectangular Openings in Corliss Engine Connecting-rods at One Set-up

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

DEVICE FOR RECLAIMING PISTON-ROD PACKING

By HARRY C. KIMBEL, Foreman Machine Shops, Central Railroad of New Jersey

The device for reclaiming Paxton-Mitchell piston-rod packing described here was designed and built by the writer for the Elizabethport, N. J., shops of the New Jersey Central Railroad. This device was developed as a result of suggestions received from the Paxton-Mitchell Co., regarding the economical use of their piston packing. It was recommended that piston-rods on which shoulders had been worn be under-cut instead of reground and that the old packing be reapplied. The device shown in the illustrations Figs. 1 and 2, which may be termed a packing re-sizing die, serves to close in the worn packing so that it can be rebored to fit the under-cut rods or new rods of any size.

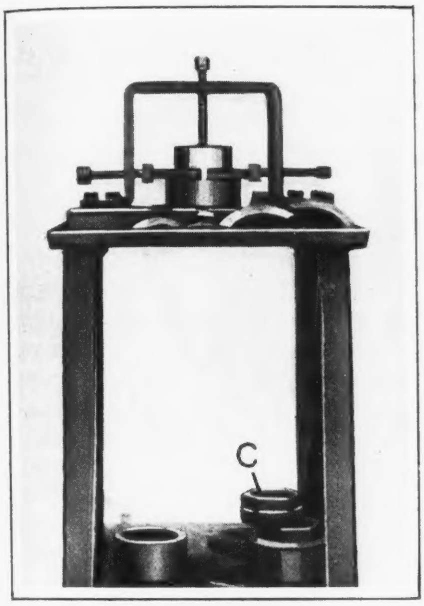


Fig. 1. Device for Resizing Piston-rod Packing

The central anvil *B*, Fig. 2, is turned to a diameter about 1/8 inch smaller than the smallest size packing used. For example, if the smallest rod is 3 1/2 inches in diameter the anvil is turned to a diameter of 3 3/8 inches. Assuming that the next size rod is 4 inches in diameter, a ring is slipped over the central anvil having an outside diameter of 3 7/8 inches. Rings of various sizes to meet all requirements are provided as part of the equipment. The contracting dies *A* are made to conform with the outside contour of new packing. The cap *D*, which is employed for 4 3/4-inch packing, has an inside diameter of 5 1/2 inches and an outside diameter of 6 1/4 inches. The tool equipment provided includes several different sizes of these caps, covering the whole range of packing sizes.

No matter how badly the packing segments are distorted, they can be brought back to their original form by forcing the die members *A* inward by means of the screws *C*. After being closed in, the packing is placed in a chuck, such as shown at *C* Fig. 1, which is mounted on the lathe for boring the piston-rod fit. The chucks *C*, which are made in different sizes, are threaded on the inside for the clamping nut and also provided with four 1/2-inch safety set-screws. These set-screws are located radially and are evenly spaced around the chuck, thus providing means for closing in the four segments which make up the packing ring. The packing is located in such a way that the end of each set-screw makes contact at about the center of a segment.

The chuck is bored to the exact size of the inside diameter of the retaining ring, while the clamping nut is bored slightly larger than a full-size standard piston-rod. It is not necessary that the segments true up all around, but they must be located exactly at right angles when applying the packing to the rod. This should not be done by guesswork, but by placing a scale along the parting strip on the packing segment and setting one ring vertical and the other ring in a horizontal position. With the reclaiming equipment described, it has been possible to save large quantities of packing collected from the various repair shops of the road.

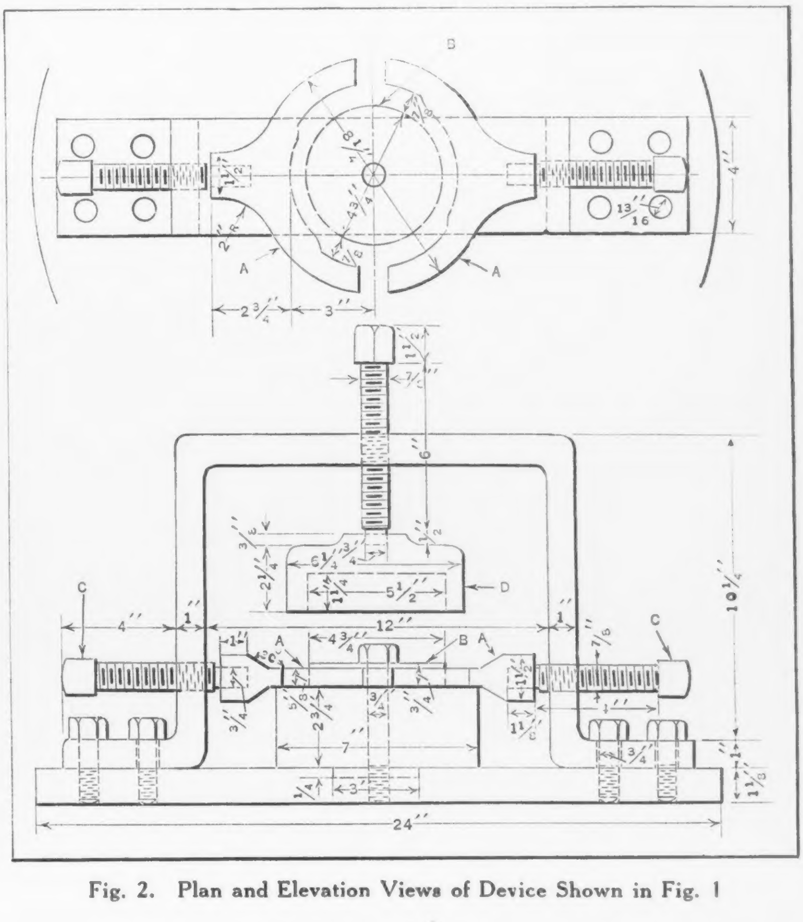


Fig. 2. Plan and Elevation Views of Device Shown in Fig. 1

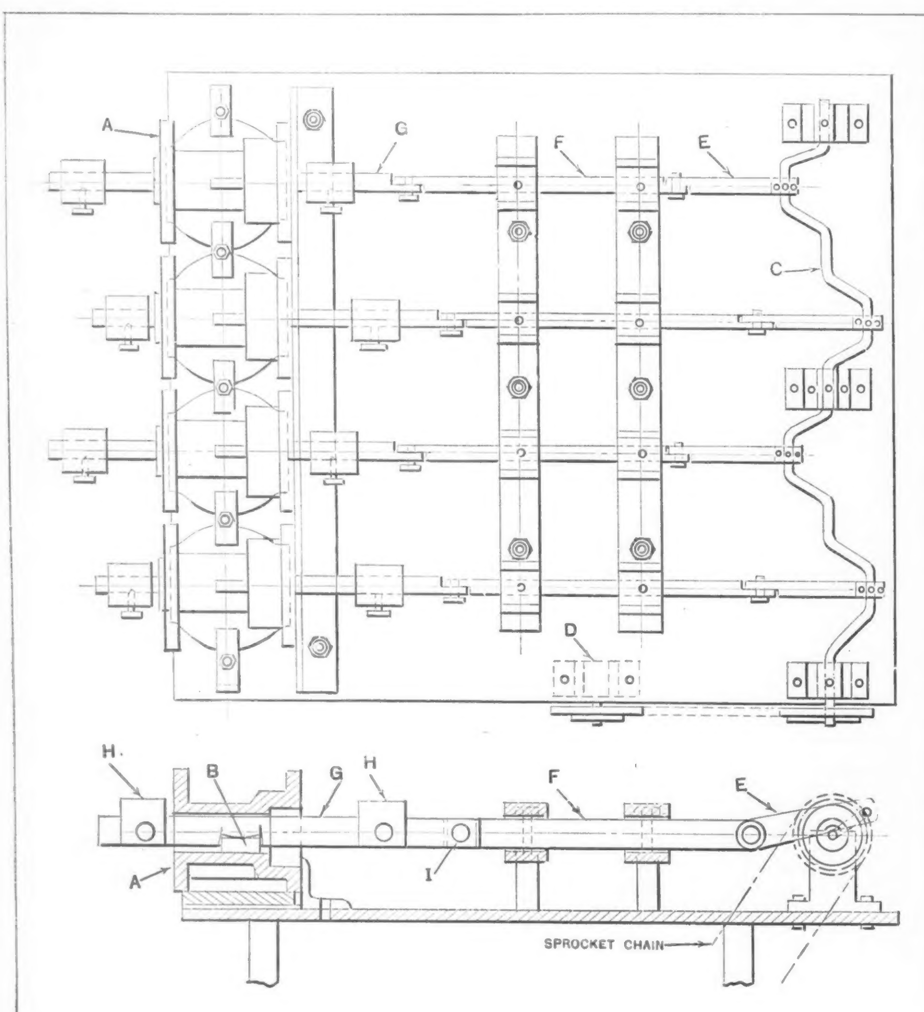
MACHINE FOR LAPPING SLIDE VALVE SEATS

By J. H. HAHN

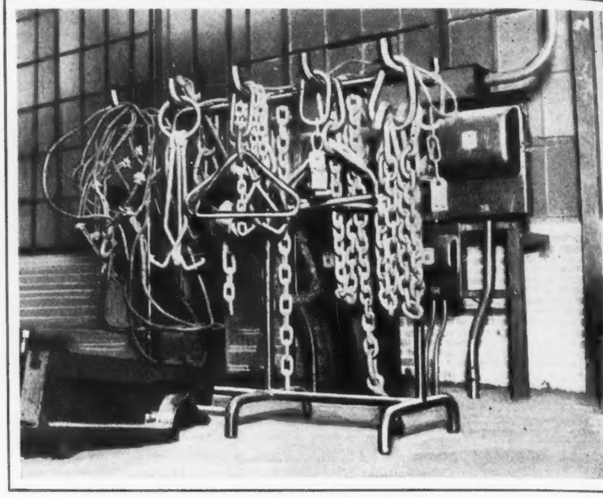
In the accompanying illustration, is shown a machine for lapping slide valve seats in triple valves. Four valves *A* are clamped to a machine at one time. The laps, one of which is shown at *B*, are pieces of steel or babbitt having the same shape as the triple slide valve. A steel lap is generally to be preferred to one made of babbitt. Trojan grinding compound of 00 grade is used, although any other similar abrasive could be employed.

The required lapping or oscillating motion is imparted to the laps by the crank *C* driven by an air motor or a small electric motor. The shaft can, of course, be driven from a lineshaft. When driven by an air motor, a bearing *D* for a sprocket wheel is secured to a shelf clamped to the supporting legs of the machine. The end of the shaft opposite the sprocket is ground to a taper fit for a portable air motor. In the case of an electric motor drive, the shaft is, of course, provided with a coupling or another sprocket to complete the drive.

From the crank, motion is imparted to the laps through connecting-rods *E*, slides *F*, and bars *G*. The bars *G* are notched to receive the laps *B*. Weights *H* clamped to bars *G* provide the necessary pressure on the laps. This pressure can be adjusted by changing the positions of the weights. The connecting-studs *I* have sufficient clearance to permit the required floating action of bars *G*.



Machine for Lapping Slide Valve Seats



Crane Chain, Hook, and Sling Rack

RACK FOR HOLDING LIFTING CHAINS

By H. H. HENSON, Foreman Machine and Erecting Shop, Southern Railway Co.

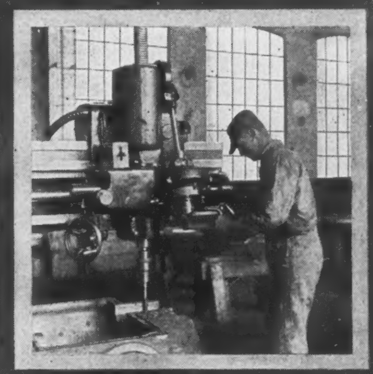
The accompanying illustration shows a convenient rack for holding lifting hooks, rope slings, and chains of all kinds used with cranes in handling and lifting heavy parts in a locomotive repair shop. The rack is made of 2-inch double-strength pipe, welded together. It is 6 feet 6 inches high and 8 feet long. The outstanding advantage of a rack of this type is that it provides a place for this equipment, which would otherwise be scattered about the building and consequently would be difficult to locate when needed.

* * *

NEW STANDARDS PUBLICATION

For the last four years the *Commercial Standards Monthly* has been the medium through which the Division of Simplified Practice of the Bureau of Standards has kept American industry advised of the progress made in the elimination of waste through simplification and standardization. Starting July 15, a monthly journal will be issued containing the information formerly sent out in the form of a mimeographed bulletin. The yearly subscription price will be $1. Orders may be placed with the Superintendent of Documents, Government Printing Office, Washington, D.C. The publication will summarize the standardization and simplification work under consideration in industry in cooperation with the Bureau of Standards.

Letters on Practical Subjects



QUICK-CHANGE DRILL- AND REAMER-HOLDER FOR LATHE

The holder shown in the accompanying illustration was designed by the writer for use in a job shop. It has served to increase production on all operations requiring the frequent changing of tools used in the tailstock of an engine lathe. The main advantage of the holder is that it eliminates the necessity for loosening or moving the tailstock back from its operating position to provide clearance for the removal of drills, reamers, or other tools ordinarily held in the tailstock. By graduating the tailstock spindle, the drills or other tools may be fed in to a uniform depth without resorting to chalking the drill or measuring with a scale.

A set of sleeves *H*, usually three, is provided with each holder. These sleeves are taper-bored to fit the largest drill shank used. The smaller drills may be held in Morse taper sockets. A slot is cut in the sleeve at *J* to permit removing the drill or socket with a standard drift. The sleeve is prevented from rotating by having the flatted end enter a slot *I* in the holder. The thrust of the drill is taken by the surface at the bottom of the groove *I*.

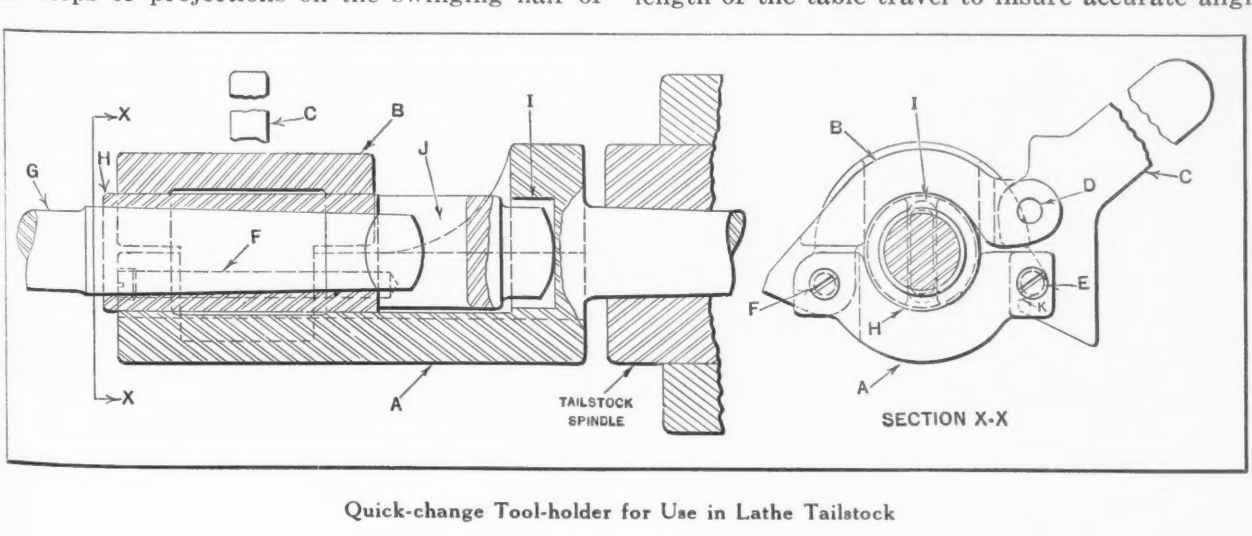
The lower half of the holder is machined integral with the taper shank, while the top half is hinged on the pin *F* and can be swung back to allow the drill and its sleeve *H* to be removed. The locking of the holder is accomplished through the action of the latch on handle *C*, which is pivoted on pin *D*. The surface *K* of the latch has a slight taper which provides a clamping action over the pin *E*. Suitable stops or projections on the swinging half of the holder and the latch lever are provided, so that the latter will not swing back too far.

Fairfield, Conn. J. E. FENNO

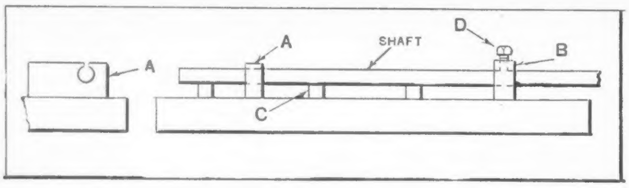
LOCATING A SHAFT FOR KEYWAY MILLING

In machine repair work, it is often necessary to replace shafts such as feed-shafts for lathes and drill presses. The cutting of a keyway the full length of one of these shafts generally necessitates resetting the work several times, assuming that the work is to be done on an ordinary milling machine. As the shaft must be moved along on the table after the table has been fed from one extreme position to the other, it is necessary that some means of accurately relocating the shaft and securing it in place be provided. If the relocating of the shaft is not done accurately, the keyway will not be properly centered at all points.

In order to facilitate the resetting of a long shaft so that a continuous and accurately centered keyway can be milled for its full length, the writer devised the arrangement shown in the illustration. The two blocks *A* and *B* were accurately machined and drilled simultaneously to suit the size of shaft to be milled. The hole drilled through the blocks is so located that the distance from the bottom of the blocks to the lower edge of the holes is exactly 1 inch. This permits using 1-inch parallels *C* to provide support at various points between the blocks. The blocks *A* and *B*, which are a sliding fit on the shaft, are clamped to the milling machine table, the shaft put in place and indicated the full length of the table travel to insure accurate align-



Quick-change Tool-holder for Use in Lathe Tailstock



Portion of Long Shaft Set up on Milling Machine Ready for Cutting Keyway

ment for the first part of the cut. Then the milling of the keyway is commenced, the cut being taken through the block *A* and up to the block *B*, which is provided with a set-screw *D* for holding the shaft in place.

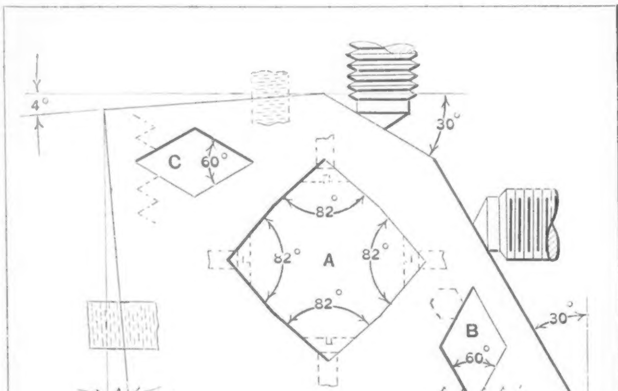
The table can then be run back, the set-screw *D* loosened, and the shaft advanced to the second milling position. A key placed in the slot in block *A* and extending into the keyway in the shaft serves to align the shaft while tightening the screw *D*. The same process of relocating the work and securing it in place after each cut is continued until the keyway has been cut the full length of the shaft. This method can be employed for almost any length and size of shaft, and the result obtained will depend on the accuracy with which the blocks *A* and *B* are set for the first part of the cut.

Erie, Pa. JOHN A. BOOSER

TEMPLET FOR DRAWING THREADS AND SCREW-HEADS

A number of templets or angles used by draftsmen have been described in MACHINERY from time to time. No one templet, however, can possibly meet all requirements. In many respects, the writer believes that the design shown in the accompanying illustration is superior for some classes of work.

The 4-degree angles at the top and left-hand end are used in drawing threads, as indicated by the dotted lines. The 30-degree angle is for drawing screw ends and the bottom of drilled holes. The opening *A* is made with an included angle of 82 degrees at four points which are parallel and at right angles with the base. This opening is used in drawing flat-head screws in any one of four positions, as indicated by the dotted lines. The openings *B* and *C* have an included angle of 60 degrees, and are used for drawing screw threads and small hexagonal nuts, either in a horizontal or a vertical position. Both sides of a thread may be drawn without turning the templet over, by sliding it to the right or to the left as required.

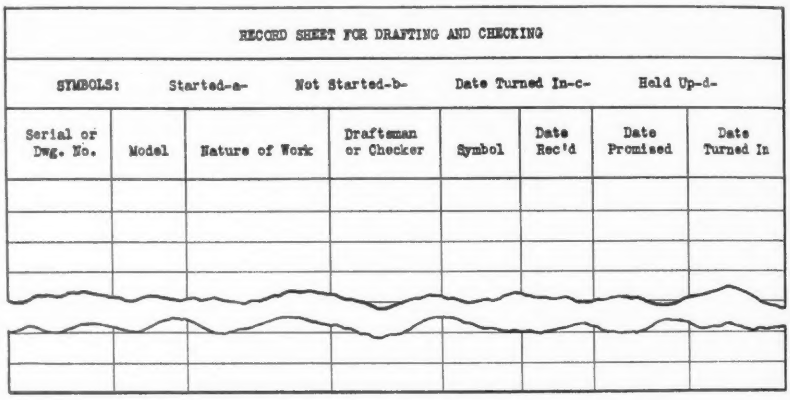


Draftsman's Templet for Drawing Screw Threads

New Castle, Ind. E. A. SISSON

RECORD SHEET FOR DRAFTING AND CHECKING WORK

A sheet or form for recording the progress of drafting and checking work, made up as indicated in the accompanying illustration, has been found very helpful by the squad leaders in the drafting-room of one company. When instructions to perform work on drawings are turned over to the squad leader of the drafting section, he notes on the record sheet the date on which the order is received and the date on which completion is promised. He then arranges to complete the drawings in time to allow for checking and a full day



RECORD SHEET FOR DRAFTING AND CHECKING

SYMBOLS: Started-a- Not Started-b- Date Turned In-c- Held Up-d-

Serial or Dwg. No.	Model	Nature of Work	Draftsman or Checker	Symbol	Date Rec'd	Date Promised	Date Turned In

Form on which Record of Drafting and Checking Work is Kept

for approval and the issuing of prints. He also notes on the record the date that the drawings are turned over to the supervisory draftsman for checking.

The squad leader of the checking section notes on his record the date on which the drawings are received from the supervisory draftsman. The date on which completion of the checking work is promised by the supervisory draftsman, the date on which the checking is completed, and the date on which the drawing is turned over to the squad leader of the drafting section are also recorded by the leader of the checking section. With a system of this kind, the progress of all work is efficiently followed up.

Philadelphia, Pa. LOUIS SHAFFER

REPLACING INCOMPLETE DRAWINGS

Whenever it is necessary to remove a drawing from the board before it is completed, provision should be made for replacing it in exactly the same position so that the edge of the T-square will coincide with all previously drawn lines, regardless of any inaccuracies that may exist in the guiding edge of the board or the T-square.

A practical method of insuring the accurate relocating of a drawing is to insert a thumb-tack in

each corner of the drawing at a point about 3/32 inch from the edge, and then draw a circle around the head of each tack. When the drawing is removed, it will be noted that a part of each circle is on the drawing and corresponding parts are on the paper that covers the board. To replace the drawing, it is simply necessary to match up the parts of the circles and replace the tacks in their original holes.

Brooklyn, N. Y. MURRAY R. MANTLEMAN

TOOLS FOR CUTTING LEATHER

Plungers, packing, and pads of leather are often incorporated in products consisting essentially of assembled metal parts. Thus it is frequently necessary to cut or form leather pieces to the required shape in the shop. The most important rule to bear in mind in cutting leather is to use a very keen-edged cutting tool, narrowed down to a sharp bevel. Three examples of successful leather-cutting

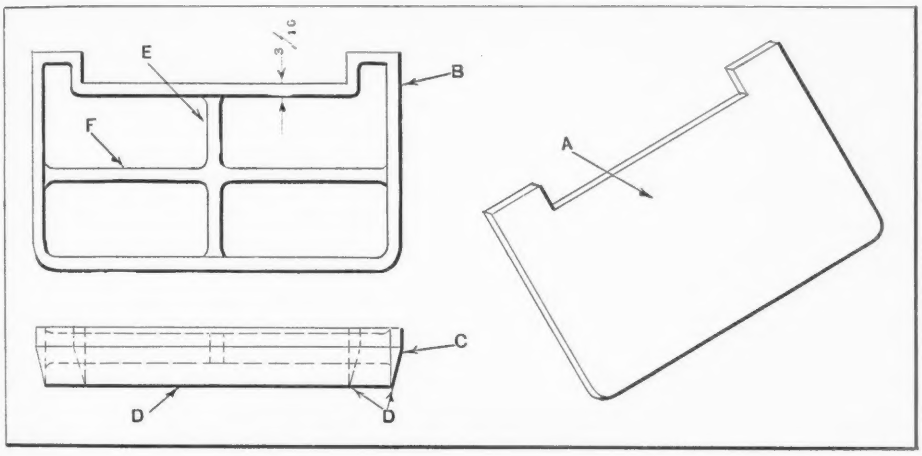


Fig. 1. Blocking out Die for Cutting Leather Covers A

tools are shown in the accompanying illustrations.

At the left in Fig. 1 is shown a steel blocking out die for cutting leather covers like the one shown at *A*. The upper view to the left shows the outline of the die, while the lower view shows how the edges are beveled to produce the keen cutting edge *D*. This die is made from bar steel, about 3/16 inch thick, bent to the shape shown at *B* in the plan view. After cross-braces *E* and *F* have been welded in place, the die is machined and ground to the finish shape and size.

In use, the steel die is placed on the leather to be cut, which, in turn, rests on a block of hard wood. Any suitable press having a flat surface on the upper member that will cover the entire die may be employed to force the cutting edges of the die through the leather.

In Fig. 3 is shown a cupped washer, such as is sometimes used in pumps of the sliding plunger type. These cups may be held in a lathe on a wooden arbor which is forced into the large cup-shaped chamber, after which the edges may be beveled with the keen-edged cutting tool *B* held in the cross-slide of the lathe and fed forward in the usual manner.

If a leather part is required to be thinned down at certain sections, the method shown in Fig. 2 may be employed. The leather to be thinned, indicated

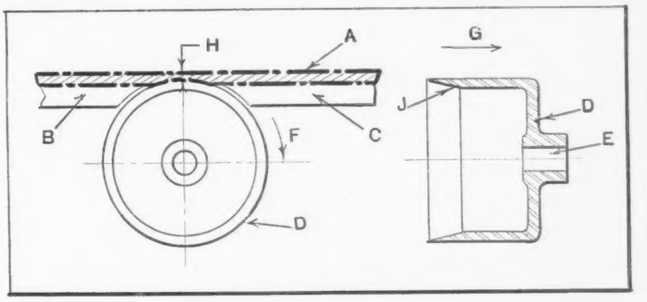


Fig. 2. Skiving Cutter Used in Thinning Down Sections of Leather

at *A*, rests on a table structure or guide plate consisting of two separate sections, *B* and *C*, machined to match the radius of the "skiving" cutter *D*. This cutter is also shown in the section view at the right.

The skiving cutter is mounted on a spindle which fits the hole *E*. As the cutter revolves at a high rate of speed in the direction of the arrow *F*, the leather *A* is forced along the guide plates *B* and *C* in the direction of arrow *G*. The leather *A* is thus thinned down as indicated at *H*. The skiving cutter is beveled at *J*, so that it has a very sharp edge which acts like, and is, in effect, a revolving knife. The plates *B* and *C* must be so adjusted that the skiving cutter will leave the required amount of leather at the point indicated by dimension *H*. A block of wood may be placed on the top surface of the leather to hold it flat while it is being pushed along the plates *B* and *C* and over the skiving cutter.

Springfield, Mass. F. H. MAYOH

SLOT MILLING FIXTURE

The milling of either a slot or a tang on small studs or pieces, such as shown at *A* in the illustration (see page 846) requires a suitable holding fixture if the work is to be done on an economical production basis. To build a fixture that is not

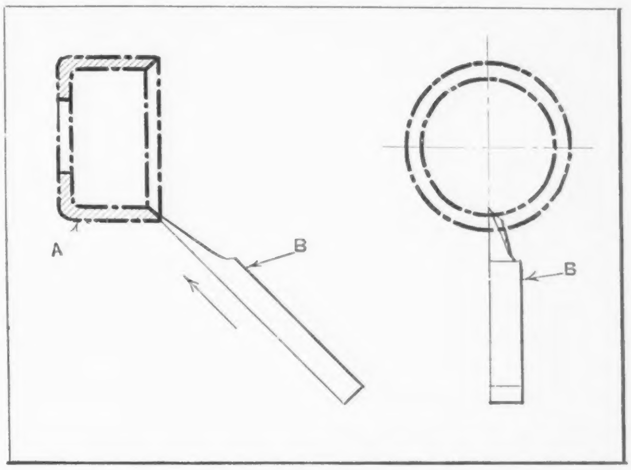
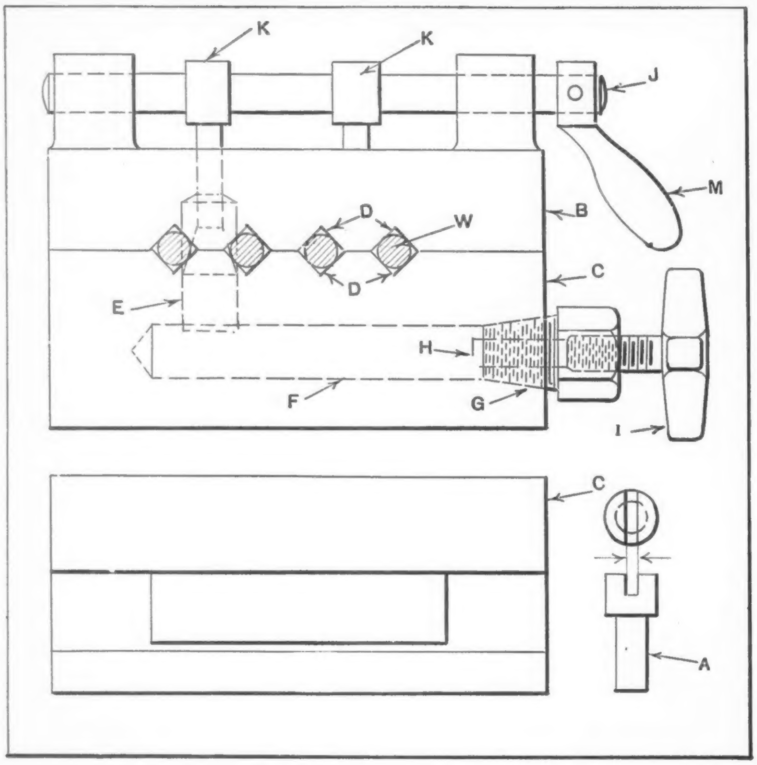


Fig. 3. Tool Used in Turning Bevel on Edge of Cup-shaped Packing



Equalizing Type of Fixture Used for Slot Milling

easily clogged with chips and is trouble-proof requires careful designing. The design shown has been found very practical. The principles on which it operates can be applied in different ways to fixtures for holding parts of various shapes.

The fixture has two hardened blocks *B* and *C* which have V-notches ground in them, as shown at *D*, into which the pieces *A* to be milled are inserted. Wedge-shaped plungers, such as shown at *E*, which are fitted into a lapped hole in the block *C*, are employed to hold the work in place. As many of these plungers are used as there are pieces to be held or, in the case of the fixture shown, one plunger may be used to hold two pieces if only a light milling cut is to be taken, but in this case the plunger must be made in two parts, the wedge end being a floating fit so that equal clamping pressure will be applied to the two parts.

All the holes in which the plungers *E* are fitted open into another hole *F* drilled at right angles to them. The latter hole is filled with beeswax, and is then closed with the plug *G* which carries a screw-fed plunger *H* provided with a hand-knob *I*. The straight end of this plunger is a close fit in the hole through which it passes.

In using the fixture, the parts are dropped into the square holes, as indicated by the cross-section views at *W*, and the hand-knob *I* turned to advance plunger *H*. The advancing plunger displaces the wax, which acts against the ends of plungers *E*, causing them to be forced forward so that the tapered portions wedge the parts firmly in place in their respective vees. The work is thus held securely while the milling operation is performed.

With this type of fixture, it is necessary to have some means of releasing the plungers after the work is completed. Releasing the pressure on the wax by turning the plunger *H* backward is not sufficient, so it is necessary to extend the ends of the plungers *E* to the outside of the plate *B*. Cams *K*, which engage the projecting ends of plungers *E*, are carried on the camshaft *J*, operated by means of a hand-lever *M*. The operation of the cams causes the plungers *E* to release the work.

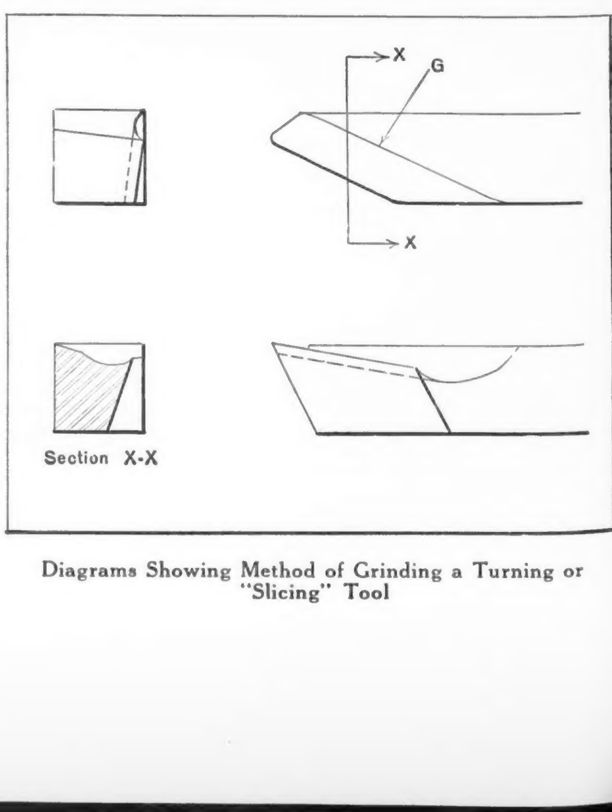
It is possible to use oil instead of beeswax to equalize the pressure, but it is difficult to obtain a sufficiently close fit for the plungers to prevent leakage of oil. Beeswax, on the other hand, will give no trouble from leakage, even over long periods of time. The diagrammatic view in the lower left-hand corner shows how the base is cut out beneath the plates *B* and *C* to provide chip space. D. B.

AN EFFICIENT TURNING TOOL

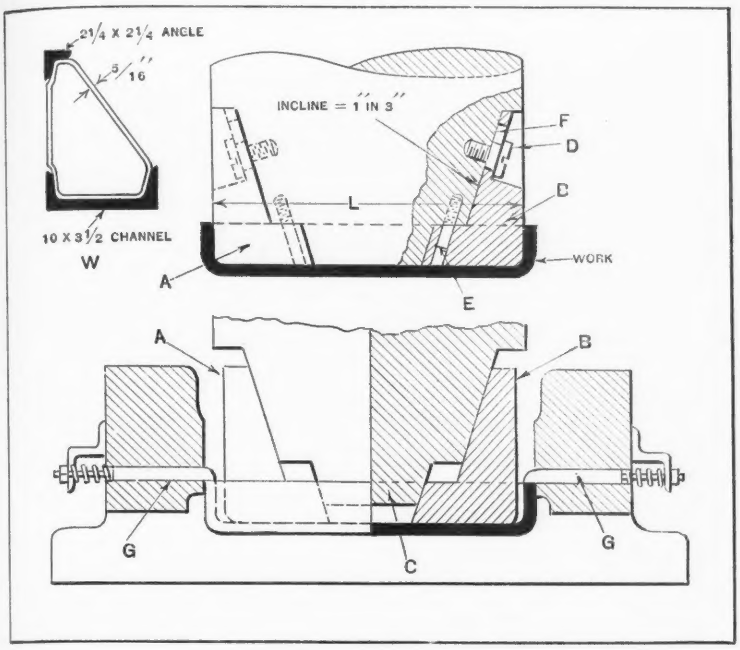
The peculiar, though effective, form of turning tool here illustrated seems to be fairly common in and around New York, but is seldom seen elsewhere. In the writer's opinion, this tool, sometimes referred to as a "slicing" tool, warrants a more general use. Its contour, which is somewhat difficult to illustrate in a drawing, is obtained by substituting for the customary flat ground surface at the usual top rake, a groove *G*, one edge of which forms the effective cutting edge of the tool.

The groove *G* is ground by holding the tool bit on the corner of the grinding wheel, and may be made any shape from a sharp-cornered vee having sides at 90 degrees to a circular arc-shaped groove having the same radius as the wheel.

A tool ground as illustrated cuts very freely, and in rapid production work is found more effective than one ground in the usual manner. The action of the ordinary metal-removing tool is not a true cutting action, but a crowding-off of metal. In sharpening an ordinary tool, we do not sharpen it so that it will cut, but give it a shape such that the stresses at the point are pure shear stresses. This is done to keep the compression forces which tend to crowd the tool point away at a minimum value. If a tool is sharpened so that it will really cut, it



Diagrams Showing Method of Grinding a Turning or "Slicing" Tool



Punch and Die for Hot-press Work

will promptly "hog in," because there is nothing to prevent it from doing so. But in the case of the tool illustrated, the groove constitutes a combined positive and negative top rake, the latter acting as a preventative against "hogging in," while the former is of such value that a real cutting action is obtained.

Willimantic, Conn. HERBERT A. FREEMAN

STRIPPER FOR HOT-PRESS DIES

While there appears to be little available information on the subject of hot-press work, much has been published on cold-drawn work in sheet metals up to 1/8 inch thick. The conditions in handling cold-drawn and hot-press work are by no means similar. In the latter case, the heating of the work introduces expansion and contraction, which does not occur in the cold-drawing operations. This obviously affects over-all sizes, particularly on large size pressings. Again, in hot-press work, the dimensions of the finished pressing are further affected by delays in stripping the work from the punch, for it is obvious that if the pressings leave the punch at different heats, there will be a variation in the permanent "sets" or in the size of the pieces.

In using a single-action press, the difficulty of stripping becomes a serious problem for the die designer, especially when mass production is required. The devices for stripping cold-drawn work from the punch usually comprise some form of spring action, although compressed air is sometimes used. Neither of these methods, however, are practical for hot-press work, where the grip on the punch is augmented by the shrinkage of the pressed part. To overcome this condition, large and powerful springs would be necessary, and it is not always convenient to make or procure these.

Under some conditions, stripping can be effected without the aid of spring or pneumatic power by employing the principle shown in the accompanying illustration. This design is simple in construction and operation and is capable of a variety of applications to hot-press work, although its advantages depend to some extent on the form of the pressing. The parts made with this particular die are triangular-shaped body brackets of the design shown in the reduced scale view at *W*.

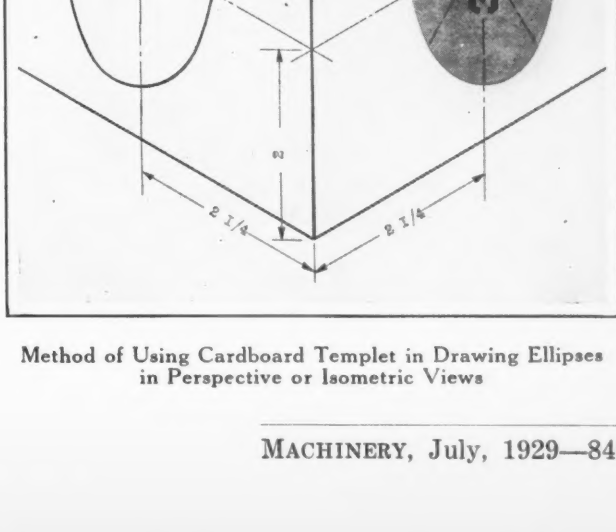
A half-section view of the punch member of the die, as fitted to the top stationary head of the press, is shown in the lower view. The two false jaws *A* and *B*, made of machine steel, are machined to fit the inclined surfaces of the punch member *C*. The jaws *A* and *B* are held in contact with the inclined surfaces of the punch by screws *D* and pins *E*. The elongated slot at *F* permits the jaws to slide down on the inclined surface for a distance of 3/4 inch. This movement reduces the over-all dimension *L* 1/4 inch or more, depending upon the degree of taper on the sliding jaws and the length of the slots *F*. The bracket is thus immediately released by the contracting punch member, and is held in the bottom die by the spring-actuated plungers *G*.

Calcutta, Ind. A. G. AMOS

TEMPLETS FOR DRAWING ELLIPSES IN PERSPECTIVE VIEWS

A comparatively complicated yet essential part of standard drafting-room routine work is the making of perspective views. In many drafting-rooms, there is a tendency to use perspective or single-view drawings whenever possible. Even when such regulations do not exist, many three-view detail and templet drawings are supplemented by perspective views of certain details or elements, in order to show points in the design that are difficult to illustrate clearly by ordinary drawings.

The ellipse, which appears on nearly every section of an isometric or perspective drawing, is perhaps the most troublesome factor in making draw-



Method of Using Cardboard Templet in Drawing Ellipses in Perspective or Isometric Views

ings of this kind, as considerable time is required to lay out its outline by the projection method. Then, too, the general adoption of pencil drawings makes it necessary in most cases to remove the construction lines, and it is rather difficult to accomplish this without smearing or obliterating other construction lines in the area adjacent to the ellipse. Additional time must then be spent in the reconstruction of lines, and the finished drawing does not have the neat appearance desired by most draftsmen. A simple but effective method of overcoming these difficulties is to employ templets like the one shown in the accompanying illustration.

A templet made of an extra good grade of cardboard, such as the one marked 3-inch diameter in the illustration, permits the outline of an ellipse to be quickly drawn without going through the tedious task of drawing numerous construction lines. In using a templet like the one shown, it is only necessary to ascertain and locate governing center lines for the hole and then lay the ellipse on the drawing in such a manner that the center lines on the drawing and those on the cardboard templet, correspond. With the drawing pencil, or pen if necessary, a line is drawn completely around the cardboard.

The ellipse shown is for a 3-inch hole. Similar templets can be made for the various sizes required to cover a range of from 1/4 inch up to and including 4 inches in 1/4-inch increments. The range in templet sizes for the larger diameters will generally be satisfactory if the increase in size is in steps of 1/2 inch.

Philadelphia, Pa. PETER HAGEN

GRAPHICAL RECORD OF JOB WORK

There are very few small shops that do not take in job work to some extent. Sometimes this is done to accommodate business friends and sometimes to fill in when the regular work is slack. It is admitted that jobbing is a hard line in which to make any money, and the man having such work to do always wants it in a hurry. It is work that requires good mechanics and an excess of supervision.

Records of job work are seldom complete; the profit on one job may be obscuring the loss on another. The number of hours worked and the amount of money received over a period of months are rarely recorded and presented in comprehensive form. For that reason, the record shown here is of interest.

Graphs have been applied to almost every conceivable angle of industrial work, but the writer doubts if job work has been so plotted before. In this case, the shop kept such a record to get a general picture of jobbing conditions rather than as a substitute for a bookkeeping system. The record is a fair average of each year, and is of value in making comparisons with the regular line of work. For example, the standard products of this company are marketed through salesmen, and it is possible to stock these more heavily at times when job work is likely to be dull. This results in a decreased labor turnover.

Some conclusions of interest may be drawn from the curves. One shows that, numerically, the jobs increase in the fall months and peak in January—this being due to industrial activities in the surrounding neighborhood. On the whole, the number of jobs coming in from month to month is fairly even, although the amount of labor and money involved fluctuates very widely.

"Dollars Earned" are gross receipts from all job work. The deepest valley in this curve comes in September, and reflects the inactivity at the summer's end before plant operations are speeded up. A still deeper point is recorded in February, but it is not of any duration—it follows the peak resulting from industrial repairs made during the inventory period. Another peak is recorded in the middle of the summer, when contractors' machinery is being pushed the hardest and replacements are called for in numbers.

It is shown conclusively that a few jobs bring in much more money than all the remainder. With

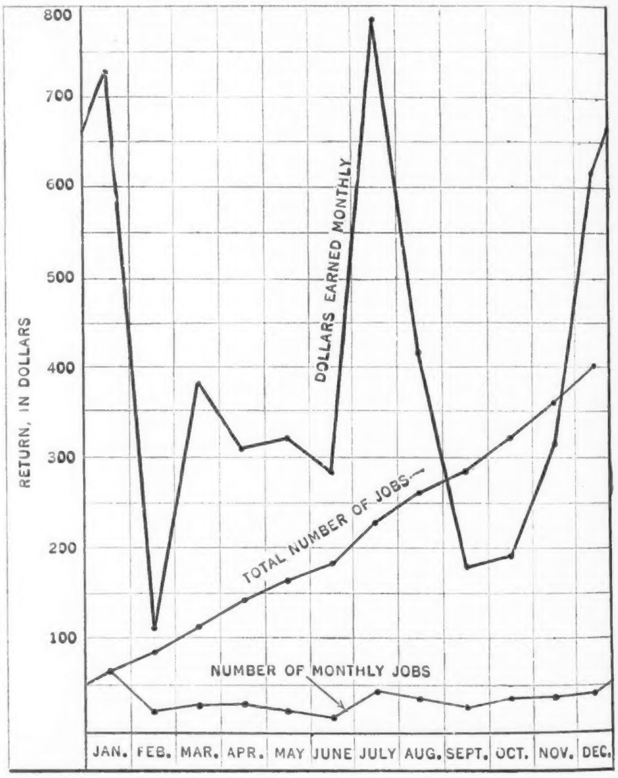


Chart Showing Record of Job Work

a fairly constant numerical average, the amount of money earned varies 7 to 1. The contractors' work generally brings in the most because it includes overtime and premium payments for rush service.

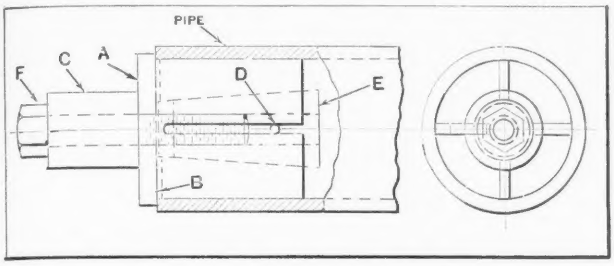
A graphical presentation of job work, such as this one, is worth while. Many pointers for plant operation may be gleaned from it, because it gives an over-all picture that figures actually conceal. The writer once heard a shop owner say that a dollar in job work was "as good as a dollar in anything else," but a graphic chart similar to the one shown, with additional curves showing labor and depreciation charges, may indicate that the "earned dollar" is overbalanced by the additional expense involved. It is obvious that unless the labor and overhead lines remain well below the line representing gross dollars received, job work is not profitable.

Middletown, N. Y. DONALD A. HAMPSON

Shop and Drafting-room Kinks

EXPANDING ARBOR FOR PIPE

The simple expanding arbor here illustrated was used to advantage in turning and threading operations on pieces of pipe that were too long to be



Expanding Arbor for Holding Pipe

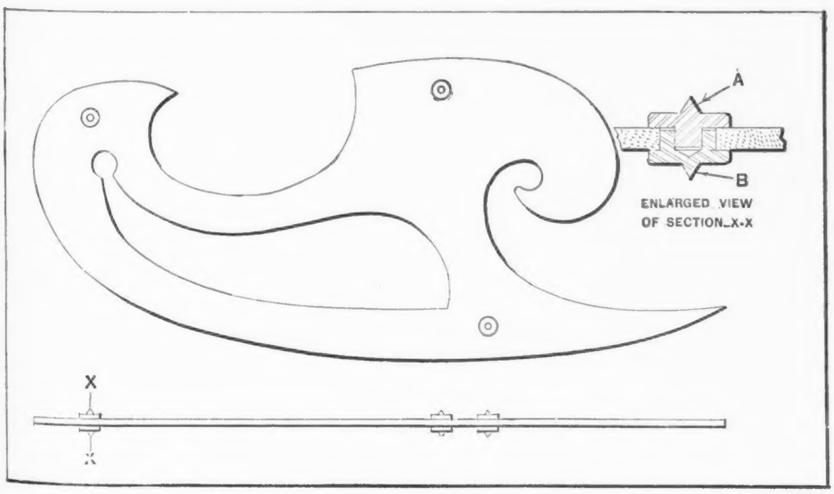
mounted between lathe centers. The body *A* of the split arbor is an easy slip fit in the pipe up to the shoulder at *B*. The end *C* of the arbor is turned down so that when it is gripped by the chuck jaws, the outside of the jaws are below the outside diameter of the pipe. The 1/8-inch pin *D*, inserted in the tapered expanding plug *E*, extends into one of the slots in the body and prevents the plug from turning within the expanding member.

In machining a piece of pipe, the arbor is placed in the end of the pipe and the body expanded by turning the screw *F*, which is threaded to fit plug *E*. Plug *C* is gripped in the chuck jaws, and the outer end of the pipe is supported in a steadyrest which is mounted on the lathe in place of the regular tailstock center. The shoulder at *B* serves to locate each pipe in the same position, so that the turning and threading operations will be uniform, provided the same tool settings are employed.

New Castle, Ind. E. A. Sisson

ANCHOR POINTS FOR IRREGULAR CURVES

The accompanying illustration shows how the writer equipped an irregular curve with anchor points to prevent it from slipping on the drawing paper or tracing cloth. The three special points, consisting of two members *A* and *B*, as shown in the enlarged section *X–X*, effectively prevent the curve from slipping. The shank of point *A* is a drive fit in the hole in point *B*. The two points permit either side of the curve to be used. As the points hold the curve about 1/32 inch above the drawing surface, the danger of ink running under the edge and causing a blot is eliminated.

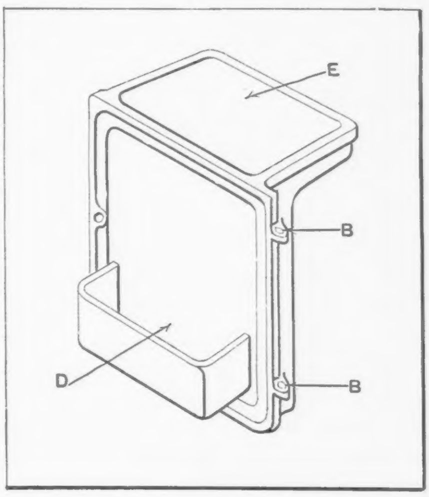


Curve Equipped with Anchor Points

Fairfield, Conn. Joseph E. Fenno

MACHINE DOORS PROVIDED WITH COMPARTMENTS

The cast-iron machine door shown in the accompanying illustration is of rather unusual construction. This door hinges on lugs *B* in the usual manner. On the inside of the door is cast a receptacle *D* for an oil-can and tools that are used only occasionally. When the door is closed, this compartment is out of sight inside the machine base. A shallow tray *E* on which the usual assortment of small tools, wrenches, etc., may be placed, is cast on the upper end of the door.



Machine Door Provided with Tray and Inside Compartment

F. H. M.

LUBRICANT FOR THREADING MONEL METAL

The difficulty frequently experienced in threading Monel metal with taps or dies is largely due to the lack of a suitable lubricant. The cutting lubricants ordinarily used for threading steel parts are not very satisfactory for threading Monel metal. The writer has found, however, that a thin mixture of red lead in ordinary machine oil is an excellent lubricant for this material. Only a little red lead should be added to the oil. The addition of the red lead gives the oil better adhesive qualities so that it will stick to the cutting surfaces. At the end of the operation, every trace of red lead must, of course, be removed from the threads.

W. E. Warner
Brentford, England

Questions and Answers

HARDENING DRILL ROD

E. R.—How can drill rod 1/8 inch in diameter, in lengths of about 10 inches, be hardened so as to remain straight after hardening? I would also like to know of any firm who is prepared to do hardening work of this kind or who sells hardened drill rod.

This question is submitted to the readers of MACHINERY.

MAKING FLAT WASHERS IN QUANTITY

W. B.—What is the most economical way to produce flat washers in quantity? In a progressive die, there is a tendency for the washers to become cup-shaped; how are they kept flat? In using a compound die, if more than three are made at once, I have difficulty with the washers dropping back on the die; also, the dies clog up because the washers stick to the top part.

Answered by A. Eyles, Moston, Manchester, England

The most logical method of producing flat washers in quantity is to employ a power press provided with a pair of feed-rolls having an intermittent motion drive obtained from the crankshaft through a ratchet and pawl. In the plant with which the writer is connected, double-sided power presses equipped with gang dies and fitted with feed-rolls are employed. No special feature is used to keep the washers flat. If the clearance between the punch and die is correct, the washers show very little tendency to become cup-shaped or distorted.

The clearance varies according to the material and class of work, and may range from 5 per cent of the stock thickness for very accurate work up to 10 per cent where accuracy is not essential. Experienced tool designers consider 6 per cent of the stock thickness to be the average clearance. In comparatively soft materials, including soft steel, the clearance is reduced to 5 per cent. The average value of 6 per cent is often employed in the production of washers from hard rolled brass and half hard rolled mild sheet steel, while 7 per cent is a satisfactory clearance for very hard rolled mild steel and spring steel.

It is advisable that all washers and piercing tools be provided with stripper and guide plates. If two guide plates are used, one on each side of the stock, allowance should be made for variation in the width of the material, also for spreading of the material resulting from the punching operation. The application of a suitable spring to one stripper plate to compensate for variations in the width of the stock is a good practice. A liberal clearance can be made between the stock and stripper plate.

It is recommended that an inclinable power press be used in order to facilitate the ejection of the flat washers. The degree of inclination depends, of course, on the work and type of die used. In the case of small, light washers an automatically operated compressed air ejector, such as is used for detonator caps for small cartridge cases, may be employed advantageously.

It may be of interest to mention that the life of blanking and forming dies has been increased considerably by chromium plating, and that the material does not adhere to the chromium-plated tools as readily as to the ordinary steel type. It is stated that the plating need be only 0.00005 inch in thickness.

Answered by Jacob H. Smit, Newark, N. J.

In using a progressive die in which the blank passes through the die, the work will be more or less cup-shaped, especially if the clearance between the punch and die is small or the pilots are tight fitting or out of line. The compound die ordinarily produces a flatter blank than a progressive die. To increase production, the writer suggests using a compound die, punching up to twelve washers at a time, the number depending on the strength of the press in relation to the area and thickness of the blanks to be punched.

To prevent the die from clogging, small movable pins may be inserted in the punches. The ends of the pins should project slightly from the end of the punch and a spring of suitable size should be placed on top of each pin. The spring-actuated pins will then push the blank washer from the punch after it leaves the die. An air-hole vent in the punch will help break the vacuum sometimes produced between the punch and the oily blank.

Probably the best method of removing the blank washers from the die and punch is to employ compressed air. Two or three suitable air nozzles, set so that the compressed air will strike the die and punch when they are separated from each other during the upward stroke of the press, should be used. Air from a pump operated by the press, or from any available source, may be employed. The air pressure depends upon the weight and area of the washers, 20 pounds per square inch being sufficient for small, light blanks, whereas heavy or wide blanks or shells may require a pressure of 60 pounds per square inch. The front end of the air nozzle should be tapered and flattened in order to sweep a surface of sufficient area to give the desired results.

When air from the shop line is used, two or three outlets should be provided. An air valve fastened to the frame of the press is placed between the tubing and the air line pipe. Just before the press ram reaches its highest point, the lever operated by the link fastened to the ram presses on the spring plunger of the air valve and releasing the air for an instant only, during the upward stroke. If possible, the press should be inclined and a roller feed employed. Cutting off the scrap stock at the end of the die when the washers are punched will generally facilitate production.

Cutting Instrument Gears on a Hand Miller

Gears for Scientific Instruments Are Cut Automatically on a Hand Miller Equipped with a Special Feeding and Indexing Mechanism

By WILLIAM GAERTNER, President, The Gaertner Scientific Corporation

CONDITIONS peculiar to the business of making scientific instruments of many types recently made it desirable for the Gaertner Scientific Corporation, Chicago, Ill., to develop special equipment for cutting a large variety of spur and bevel gears, ratchets, crown clutches, racks, etc. Obviously all such parts used in scientific instruments must be finished to an unusually high degree of accuracy. After considerable thought, a hand milling machine of standard construction was purchased and fitted for the service mentioned by equipping it with a work feeding and indexing mechanism. This machine is shown in Figs. 2 and 3 provided with the special equipment. Typical work turned out by the machine is illustrated in Fig. 1.

Spur and Bevel Gears Cut on the Same Machine

One of the features of this equipment is that it is adapted for cutting both spur and bevel gears. Standard involute-tooth gear-cutters are employed, spur gear cutters being used for producing bevel gears up to about 40 diametral pitch. When the ratio of the mating bevel gears is high, it is usually desirable to take two cuts on the teeth, but otherwise, one cut is sufficient.

Gears as small as 1/8 inch pitch diameter and as large as 4 inches pitch diameter have been cut with teeth as fine as 120 diametral pitch (0.0262 inch circular pitch) and as coarse as 24 diametral pitch (0.1309 inch). Many crown clutches with either square or angular teeth have been made.

Drive to the Special Mechanism

With the special mechanism provided on this hand milling machine, practically any ratio of cutter speed and table feed is available to obtain the required cutter and table movements for fine and coarse work, in the sense that "coarse" is here employed. Figs. 2 and 3 show a typical set-up, the cutter being shown at *A* and the work at *B*.

Power is delivered to the machine in the regular manner through a belt connecting the cone pulley and an overhead countershaft, the cutter-spindle and arbor thus being driven direct. On the rear end of the machine drive shaft, there is a sprocket that transmits power through a chain to a second sprocket connected to the special mechanism. From this point, the power is delivered to the change-gear unit seen at the right in Fig. 3, which furnishes two drives through universal shafts *C* and *D*.

How the Work-table is Reciprocated

Shaft *C* provides the power for feeding and returning the work-table at rates governed by the

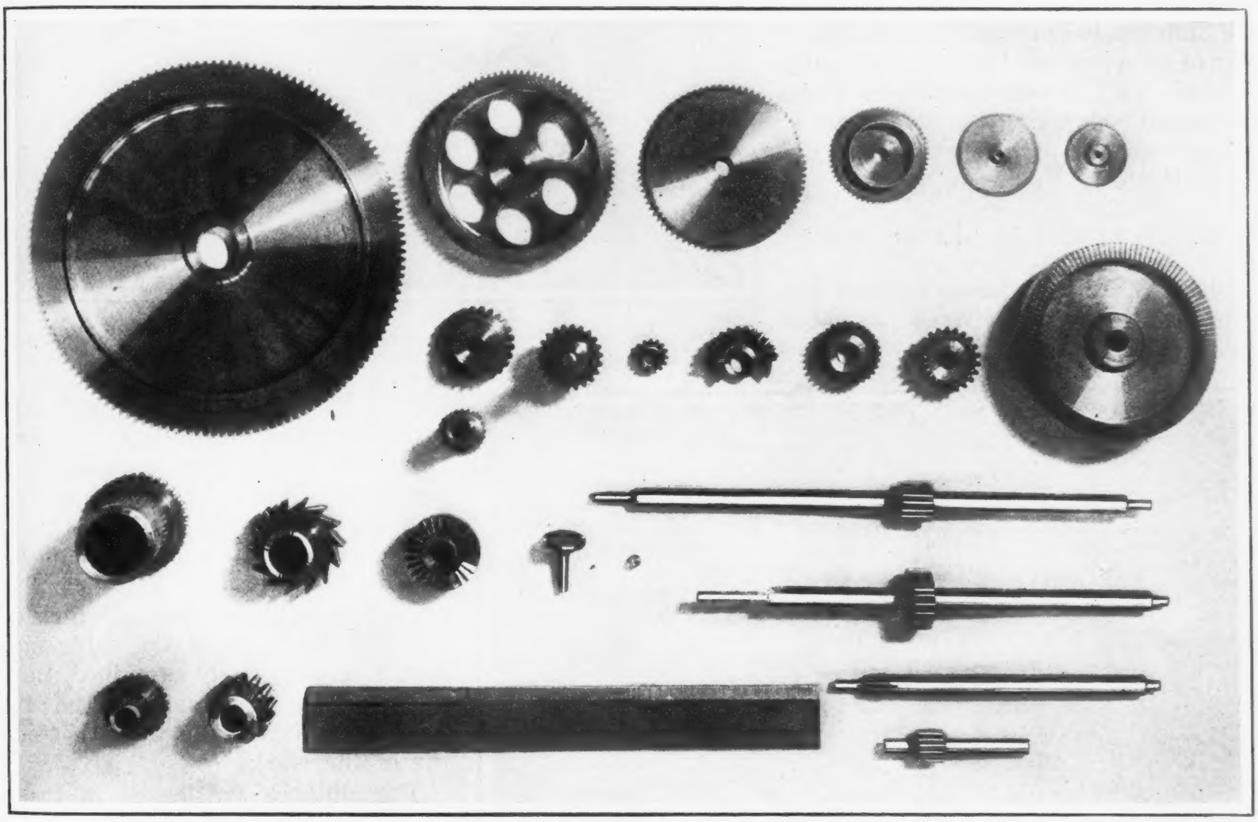


Fig. 1. Spur and Bevel Gears and Other Parts Cut on the Hand Milling Machine for Use in Scientific Instruments

change-gears. The drive is transmitted to worm E, Fig. 4, which, through worm-wheel F, actuates the forward movement of the table during which the cut is taken, and through worm-wheel G the return movement of the table. This return movement is always considerably faster than the forward movement, worm-wheel G being smaller in diameter than worm-wheel F.

These two worm-wheels transmit power alternately through the action of clutches H and J, both of which are operated by blocks fastened to the lever unit K. Gears L and M, which are driven through clutches H and J, respectively, both mesh with a pinion indicated at X. This pinion is mounted on the table feed-screw and drives the screw either clockwise or counter-clockwise, depending upon which of the clutches is transmitting the drive. Worm-wheels F and G are constantly in mesh with the driving worm. The manner of operating the lever unit K to actuate the clutches will be described later.

Manner of Effecting the Indexing

Shaft D, Fig. 3, delivers power for indexing the work between the table reciprocations and for reversing the table. It drives worm N, Fig. 4, which meshes with worm-wheel O. Keyed to the same shaft as the worm-wheel are two cams P and Q; cam Q contacts with a roller on link R. When this link is operated by the action of cam Q, it swivels the lever unit K sufficiently to operate clutches H and J, which control the direction of the table movements, as previously explained. In this manner, the reversal of the table movements is tied up with the indexing of the work.

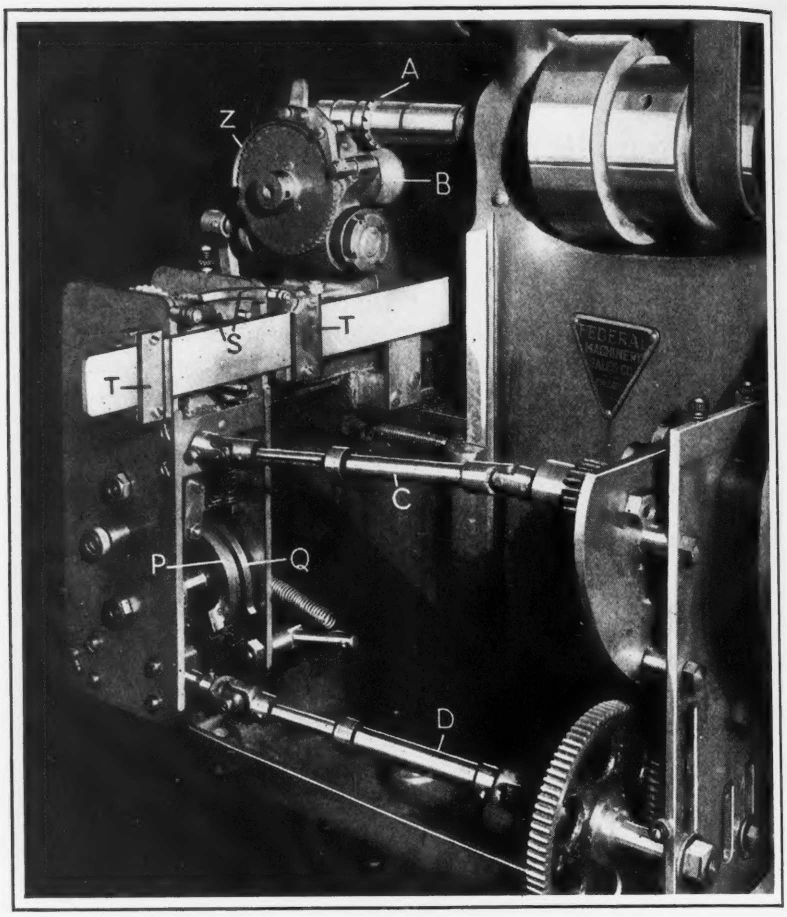


Fig. 3. Another View of Gear-cutting Equipment, Showing Change-gears and Separate Drives for the Table and Indexing Movements

The clutches are locked in the engaged and disengaged positions by two trip-dogs S, Figs. 2 and 3, which contact with stops T at the end of the forward and return movements. The trip-dogs engage the rod that connects the two side bars K at the upper end. The stops T are adjustably mounted on a bar fastened to the side of the table saddle, the special mechanism itself being mounted on one end of the table and moving with it. A coil spring tends to hold the clutches disengaged.

Indexing of the dividing head which holds the work is effected through cam P. This cam actuates a system of levers and rods which transmit motion to rod U of the dividing head. Mounted on rod U is a worm which is moved axially with the rod to rock a worm-wheel segment V, Fig. 5. As this

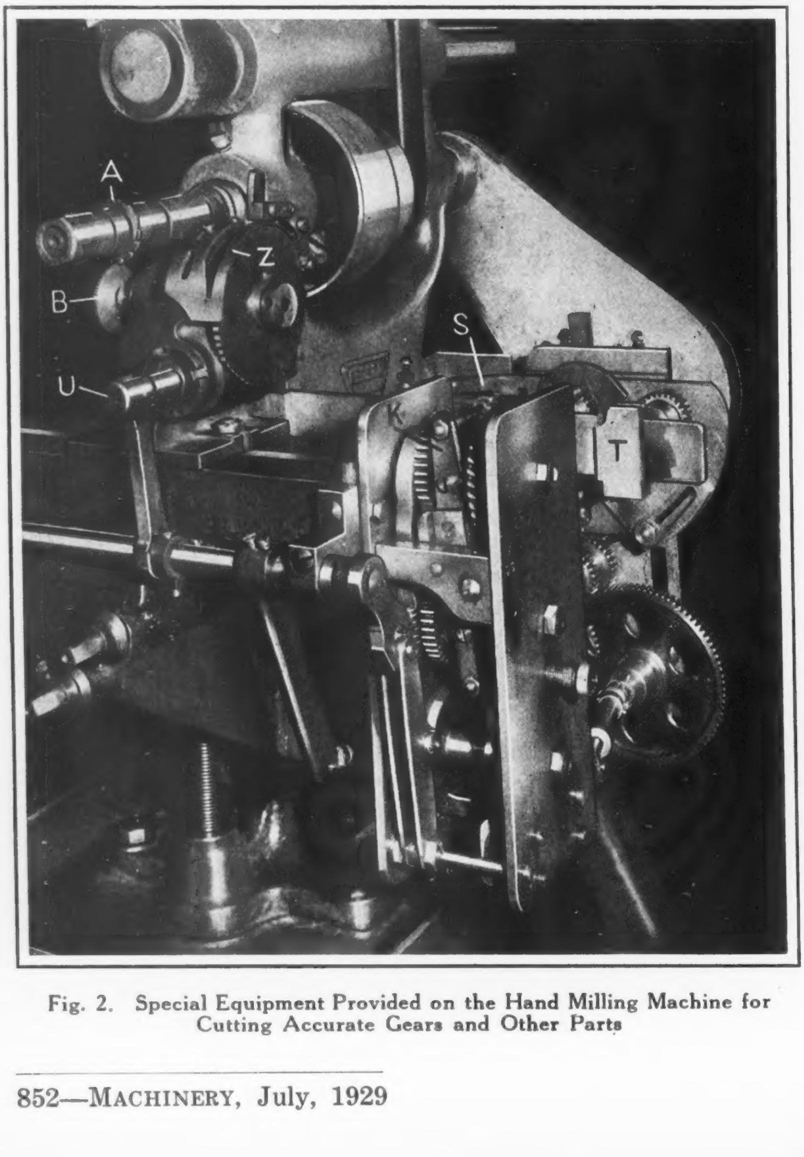


Fig. 2. Special Equipment Provided on the Hand Milling Machine for Cutting Accurate Gears and Other Parts

worm-wheel segment is swiveled, it moves arm W, operating pawl Y through a connecting link.

The pawl is entirely raised from the teeth of the index-plate on its forward movement, so as to eliminate drag on the teeth which would cause wear, and also to guard against indexing the work in the wrong direction. This complete lifting of the pawl has been accomplished by locating center a slightly on this plate during the return movement until it falls into the proper tooth of the index-plate. With this arrangement, the pawl can be made to move the index-plate any number of tooth spaces from one upward, in spite of the fact that the pawl stroke always remains the same. A locking device prevents the pawl from pulling the index-plate too far forward. Arm d, Fig. 5, on which the pawl is

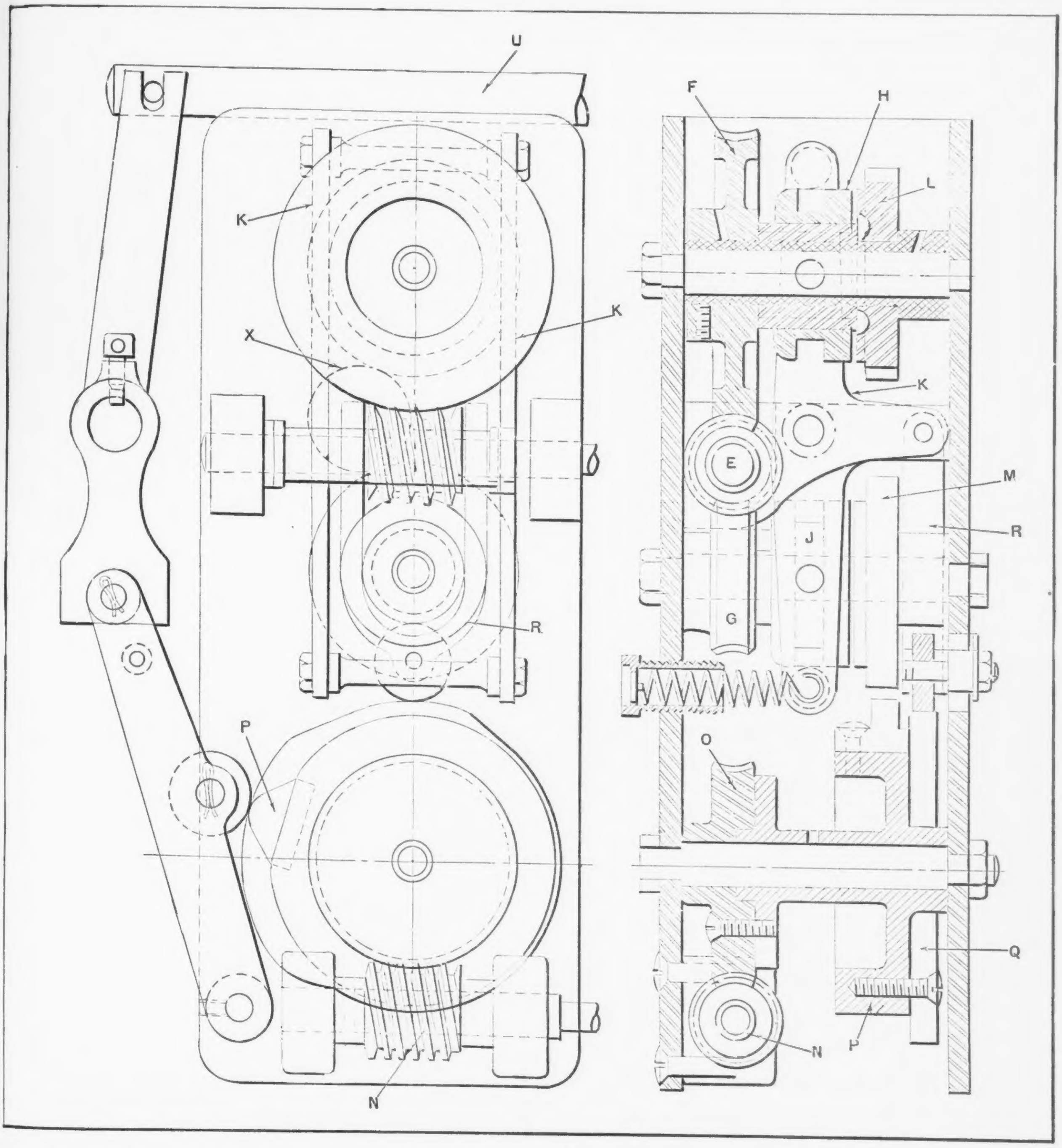


Fig. 4. Details of the Unit Mounted on One End of the Work-table for Actuating the Table Movements and Controlling the Operation of the Dividing Head

above a direct line between centers b and c. In addition to raising the pawl entirely from the index-plate teeth, this construction firmly pulls the pawl into mesh with these teeth for the indexing.

The exact amount of index-plate movement for each operation of pawl Y has been made independent of cam P, Fig. 4, and hence this cam need rarely be changed. On the dividing head there is an adjustable plate Z, Fig. 5, so set that the pawl is lowered on it at the end of its stroke and slides hinged is held by friction in position on worm-wheel segment V.

Dividing Head Tilted for Cutting Bevel Gears

For cutting bevel gears, the spindle housing of the dividing head is swiveled the required amount about the axis of rod U, the teeth of worm-wheel segment V merely sliding around the worm threads on the rod. Means are provided for locking the housing in these angular positions.

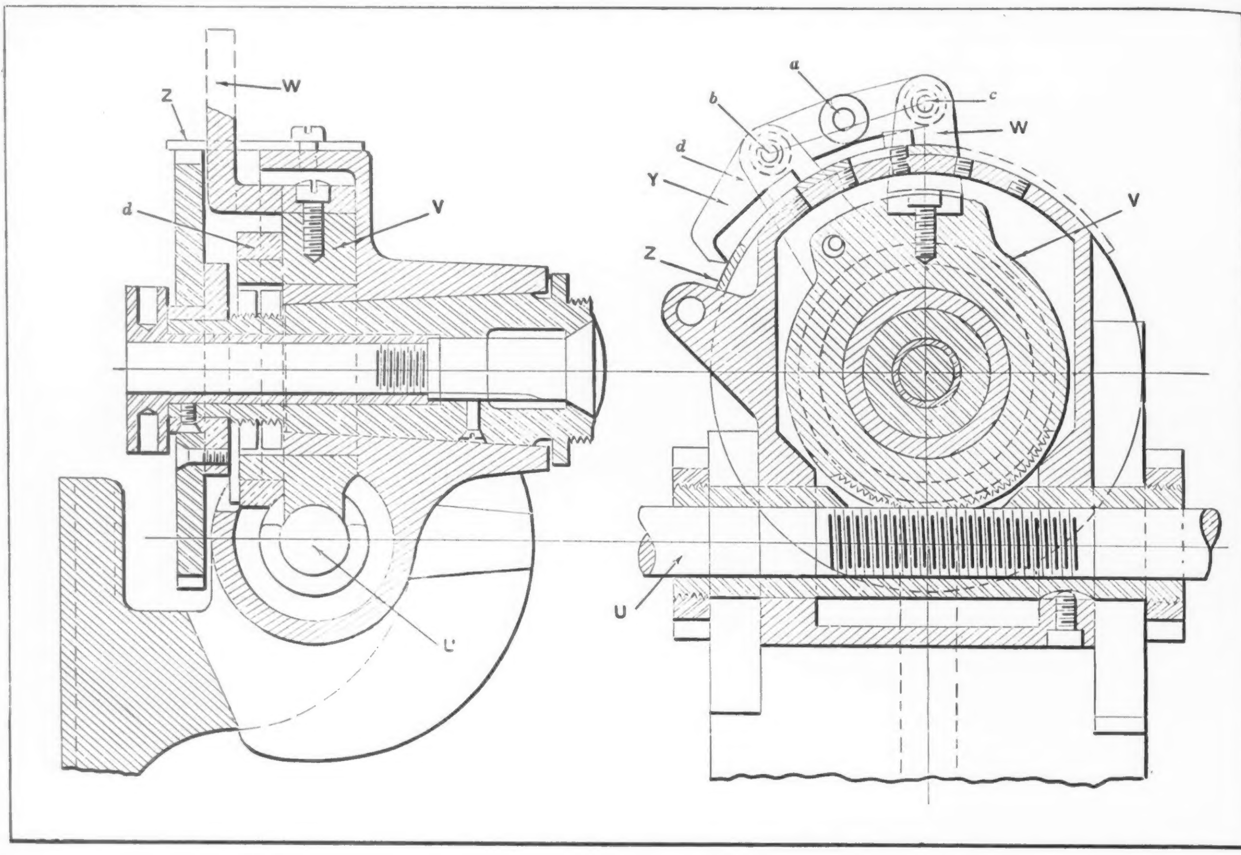


Fig. 5. Cross-sectional Views of the Dividing Head Unit

Cutting the Teeth of Gear Racks

For cutting racks, the dividing head is removed from the milling machine table and replaced by the fixture illustrated in Fig. 6, which is mounted on a circular base so that it can be conveniently swiveled to any desired angle. The indexing mechanism part of the special equipment is disconnected for such operations and runs idle, but the table feed and reversing parts of the mechanism are employed in the manner described. After the first cut has been taken over a quantity of racks held in the fixture, accurate indexing for succeeding cuts is accomplished by means of the indexing mechanism seen mounted at the left-hand end of the fixture feed-screw.

* * *

And now we have the refrigerated airplane! This may sound paradoxical, inasmuch as most of us know that the higher we go the colder it gets. Be that as it may, a New Mexico firm has ordered three planes equipped with refrigerating apparatus for shipping shrimps. —*Compressed Air Magazine.*

SAVINGS IN POWER TRANSMISSION

In an address before the National Supply and Machinery Distributors Association, W. S. Hays, executive secretary of the Power Transmission Association, called attention to the savings that may be made by thoroughly studying transmission problems in manufacturing plants. He cited numerous examples, mentioning one case in which, by replacing one type of belt with another on 300 machines, a saving of about $35 per machine was made, or a total saving of about $10,500. In another plant, by simplifying the power transmission equipment, preventable losses were reduced from 30 per cent to 3 or 4 per cent. In another case, a survey showed that changing to different types of belts better adapted to the work in hand, an initial outlay of $50,000 would be saved within less than a year. The power transmission industry must base its sales on accurate data, and the Power Transmission Association has set out to provide the facts required.

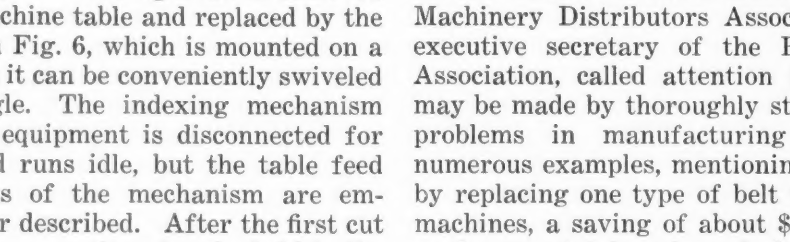


Fig. 6. How the Machine is Set up for Cutting the Teeth of Gear Racks

Testing Ball Bearings—Right and Wrong Way

Laboratory Tests as Usually Conducted are of Little Value, as They Do not Indicate Accurately the Capacity of a Ball Bearing

By ASHER GOLDEN, RBF Ball Bearing Co., New York City

THE idea expressed in the sub-title of this article may be considered a rather unusual assertion, but the author will endeavor to prove that it is true. Not every manufacturer who uses ball bearings in equipment built by him has a special machine for testing them. Those who have not, depend upon a trial under actual working conditions to show whether or not the bearings are suitable for their purposes. The bearings to be tested are installed in machines that go out to regular customers in the ordinary course of business, and if, after what is considered a sufficiently long time, the customer does not complain, or if, on inquiry, he reports that the machine is satisfactory, it is assumed that the bearings are all right.

Such working tests may last for six months or a year, or even two years or more. However, they do not necessarily give a true measure of the capability of a bearing, since the conditions under which bearings are used vary in different plants, but such tests are at least dependable. A better method would be to install bearings in several machines that go to different customers, and to keep track of the performance. But even where bearings are tested or tried in a single machine, the results are more dependable than laboratory tests.

What is the Purpose of a Laboratory Test?

The purpose of a laboratory test is not so much to determine the smoothness or quietness of a bearing as to find out how long it will run; in other words, the test is chiefly for endurance. That brings us to the question: What is an endurance test as applied to a ball bearing? Is it a test to see how long a bearing will run in the laboratory under actual working conditions, and under the watchful eye of an observer? No; that would take too long. The test is of the breakdown variety. It is run for a few hours until the bearing fails. Evidently the only way to accomplish such a result is to impose an exceptionally high load on the bearing.

Here is a bearing that has a catalogue rating of 650 pounds radial load at 1500 revolutions per minute. One user tests the bearing by imposing a radial load of 1830 pounds and a simultaneous thrust load of 1830 pounds—in other words, about six times the rated radial capacity! All bearings of this particular size are tested under the same loads and at the same speed. The bearings that endure the longest are approved. A person with a superficial knowledge of and little experience with ball bearings would draw the inference that such a test must be a fair one, because all the bearings are tested under the same conditions. Are they?

Relation of Radial and Thrust Loads

Before we proceed, let us clear up a prevalent misunderstanding about the simultaneous application of radial and thrust loads. Ratings of bearings as 50 per cent thrust, 100 per cent thrust or 200 per cent thrust, etc., are likely to give a ball-bearing user an idea that, if a particular bearing has a catalogue radial rating at a certain speed of 500 pounds, for example, as much as 500 pounds radial load may be imposed upon it, and in addition, it will sustain a thrust load of 250 pounds, 500 pounds or 1000 pounds, as the case may be. There is nothing farther from the truth. If the radial rating of a bearing is 500 pounds, which we assume is the maximum with a proper factor of safety, then it will sustain for this factor of safety 500 pounds radial load without any thrust load; if it be desired to impose a thrust load upon the bearing, the radial load must be proportionately diminished.

So we see that in the test described, the radial load is about three times the radial capacity; imposing a simultaneous thrust load of 1830 pounds is equivalent to doubling the radial load.

Testing Bearings under Conditions that Prevent Accurate Conclusions

Now, when the user states that the bearings are tested under the same conditions, what does he mean? Simply this, that they are tested under the same load and at the same speed. Is that all we need to know in making a comparative study of the capabilities of two bearings? It would probably be sufficient if all the bearings were tested at what might be considered normal loads, but to test bearings under such conditions would take several months. So a period of several months is crowded into a few hours; but when you do that, it becomes an absolute impossibility to test the bearings under the same conditions in a commercial laboratory.

Take two men of apparently the same physical characteristics and set them, first one and then the other, to doing the same manual labor under the same normal conditions; in all probability, they will work on without fatigue for a great length of time. Even marked differences in external temperature, humidity, the food they eat, and the clothes they wear will have little, if any, effect upon their endurance. But set these men at work that requires four or five or six times normal effort and you will find that the conditions are entirely different. Slight differences in temperature and humidity between the two trials, slight differences in the food, the tightness or looseness of their clothing, etc., will have an effect upon their endurance.

So it is with two bearings, even of the same make. If they are tested one after the other under normal conditions, normal external influences will have little effect upon their endurance. But when they are under enormous stress, the slightest variations in the external conditions will cause one bearing to break down before the other.

Here are a few factors that may vitiate any result when bearings are tested under severe stress:

1. Differences of room temperatures.
2. Differences in the viscosity of the lubricant.
3. Particles of dirt not readily visible while in the lubricant.
4. Fit of the bearings on the testing machine spindle and in the housing.

The fourth factor is by far the most important, since a slightly tighter fit will impose a greater load on a bearing, and this will not be shown on a dial or indicated by the weight usually applied to load a bearing.

How Ball Bearings should be Tested to Obtain Reliable Results

A true comparison of two bearings of a given size may be made only if the conditions under which they are tested are absolutely identical. These conditions are:

1. The loads must be precisely the same as shown by the testing machine.
2. The fits for the shaft or spindle and the housing must be the same.
3. The bearings must be tested by the same person to eliminate any possible errors of observation.
4. The lubricant must be absolutely the same—the same brand, quality, and viscosity—and it must be absolutely clean.
5. The room temperatures must be the same.
6. The temperature of the machine must be the same at the beginning of the tests.
7. The bearings must be perfectly clean to begin with.
8. Atmospheric conditions, such as humidity, barometric pressure, etc., must be the same.

It may be argued that the observance of these considerations is splitting hairs; it is, but it is absolutely necessary to take them into account in a laboratory test such as described; under normal conditions, they may be safely neglected. Bearings operating under a load six times as great as they have to bear normally are in a state of extreme tension, where every little variation is a disturbing factor.

* * *

An educational motion picture showing the construction of arc-welded pipe lines has been recently completed by the Lincoln Electric Co., Cleveland, Ohio. This film begins with the arrival of the pipe from the mill, and then each successive step in the construction of the welded pipe line is shown. The picture consists of two reels, and may be obtained without charge for showing to technical and industrial associations, societies, engineering schools, etc.

Chromium-plated Molds for Bakelite

The advantages gained by the use of chromium-plated molds, a number of points to be considered in the application of the plating, and various questions relating to the use of plated molds and hobs will be dealt with in an article, "Chromium-plated Molds for Bakelite Parts," to be published in August MACHINERY. The principal object of chromium-plated molds is to increase the durability of the molding surfaces; the life of molds has been increased from ten to fifteen times by plating. Furthermore, a molded piece can be more easily released or discharged from the mold cavity if it has been chromium-plated, and molded threads can be more readily unscrewed from a chromium-plated mold than from an unplated one. A chromium plate 0.0002 or 0.0003 inch thick has proved sufficient for good results. Chromium-plating the molds also aids in preventing them from rusting.

FIRST NATIONAL METAL CONGRESS

The first Metal Congress, which it is planned to hold annually hereafter, will assemble in Cleveland, Ohio, September 9 to 13, simultaneously with the annual meeting of the American Society for Steel Treating and the Eleventh National Metal Exposition to be held in the Cleveland Public Auditorium during the same week. At the Metal Congress, papers will be presented relating to the production, treatment, fabrication, and use of metals, both ferrous and non-ferrous. Reports on the progress made during the year in the field of research will also be presented.

During the same week as the meeting of the Metal Congress, the American Welding Society, the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers, the Iron and Steel Division of the American Society of Mechanical Engineers, and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers will hold their national fall meetings.

The exposition, held under the auspices of the American Society for Steel Treating, will occupy the Public Auditorium of Cleveland. Over 200 exhibitors have already subscribed for display space. The exhibits will include steel and non-ferrous metals, heat-treating equipment, welding equipment, hardness testing equipment, and metal-working tools for various purposes. Many of the exhibits will be demonstrated in action. At the exposition will be shown for the first time many new developments that have been introduced during the past year.

* * *

THE GERMAN MACHINERY INDUSTRY

According to Trade Commissioner James E. Wallis, Jr., Berlin, Germany, official German statistics and the annual reports of the German Machinery Manufacturers' Association indicate that 1928 was an active year in the German machinery industry. The value of the production of the entire German machinery industry in 1928 is estimated at approximately $1,000,000,000. The production capacity of the industry is estimated at approximately $1,400,000,000; hence, the industry was occupied at about 70 per cent of its capacity. The domestic sales were valued at about $700,000,000 and exports at about $300,000,000. Compared with 1913, prices of machinery in 1928 were approximately 40 per cent higher than in the pre-war year, while the wages of skilled workers were about 65 per cent greater and the cost of living was estimated to be about 50 per cent more. The production in 1928 was about 4 per cent greater than in 1913. The production capacity, in 1928, however, was 45 per cent greater than in 1913.

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MACHINERY'S DATA SHEETS 157 and 158

TEMPLETS FOR DRILLING CAST-IRON FLANGED PIPE FITTINGS

For Maximum Working Saturated Steam Pressure of 125 Pounds per Square Inch (Gage)

Approved by American Standards Association

Nominal Pipe Size	Diameter of Flange	Thickness of Flange[3] (Min.)	Diameter of Bolt Circle	Number of Bolts[1]	Diameter of Bolts	Diameter of Drilled Bolt Holes[1]	Length of Bolts[2,4]	Size of Ring Gasket
1	4 1/4	7/16	3 1/8	4	1/2	5/8	1 1/2	1 by 2 5/8
1 1/4	4 5/8	1/2	3 1/2	4	1/2	5/8	1 1/2	1 1/4 by 3
1 1/2	5	9/16	3 7/8	4	1/2	5/8	1 3/4	1 1/2 by 3 3/8
2	6	5/8	4 3/4	4	5/8	3/4	2	2 by 4 1/8
2 1/2	7	11/16	5 1/2	4	5/8	3/4	2 1/4	2 1/2 by 4 7/8
3	7 1/2	3/4	6	4	5/8	3/4	2 1/4	3 by 5 3/8
3 1/2	8 1/2	13/16	7	8	5/8	3/4	2 1/2	3 1/2 by 6 3/8
4	9	15/16	7 1/2	8	5/8	3/4	2 3/4	4 by 6 7/8
5	10	15/16	8 1/2	8	3/4	7/8	2 3/4	5 by 7 3/4
6	11	1	9 1/2	8	3/4	7/8	3	6 by 8 3/4
8	13 1/2	1 1/8	11 3/4	8	3/4	7/8	3 1/4	8 by 11
10	16	1 3/16	14 1/4	12	7/8	1	3 1/2	10 by 13 3/8
12	19	1 1/4	17	12	7/8	1	3 1/2	12 by 16 1/8
14 O.D.	21	1 3/8	18 3/4	12	1	1 1/8	4	14 by 17 3/4
16 O.D.	23 1/2	1 7/16	21 1/4	16	1	1 1/8	4 1/4	16 by 20 1/4
18 O.D.	25	1 9/16	22 3/4	16	1 1/8	1 1/4	4 1/2	18 by 21 5/8
20 O.D.	27 1/2	1 11/16	25	20	1 1/8	1 1/4	4 3/4	20 by 23 7/8
24 O.D.	32	1 7/8	29 1/2	20	1 1/4	1 3/8	5 1/4	24 by 28 1/4
30 O.D.	38 3/4	2 1/8	36	28	1 1/4	1 3/8	5 3/4	30 by 34 5/8
36 O.D.	46	2 3/8	42 3/4	32	1 1/2	1 5/8	6 1/2	36 by 41 1/4
42 O.D.	53	2 5/8	49 1/2	36	1 1/2	1 5/8	7 1/4	42 by 47 7/8
48 O.D.	59 1/2	2 3/4	56	44	1 1/2	1 5/8	7 1/2	48 by 54 3/8
54 O.D.	66 1/4	3	62 3/4	44	1 3/4	2	8 1/4	54 by 61
60 O.D.	73	3 1/8	69 1/4	52	1 3/4	2	8 1/2	60 by 67 1/2
72 O.D.	86 1/2	3 1/2	82 1/2	60	1 3/4	2	9 1/2	72 by 80 5/8
84 O.D.	99 3/4	3 7/8	95 1/2	64	2	2 1/4	10 1/2	84 by 93 1/2
96 O.D.	113 1/4	4 1/4	108 1/2	68	2 1/4	2 1/2	11 1/2	96 by 106 1/4

[1]The number of holes in drilling templets are in multiples of four, so that fittings may be made to face in any quarter. The bolt holes are to straddle the center line.

[2]The bolt holes on cast-iron flanged fittings are not spot-faced for ordinary service. When required, the fittings and flanges in sizes 36 inches and larger can be spot-faced or back-faced, so that standard length bolts can be used.

[3]All cast-iron standard flanges for 125-pound per square inch working pressure have a plain face.

[4]For bolts 1 3/4 inches in diameter and larger, bolt-studs with a nut on each end are recommended.

MACHINERY'S Data Sheet No. 157, New Series, July, 1929

TEMPLETS FOR DRILLING CAST-IRON FLANGED PIPE FITTINGS

For Maximum Working Saturated Steam Pressure of 250 Pounds per Square Inch (Gage)

Approved by American Standards Association

Pipe Size Nominal	Diameter of Flange	Thickness of Flange[3] (Min.)	Diameter of Raised Face	Diameter of Bolt Circle	Number of Bolts[1]	Diameter of Bolts	Diameter of Drilled Bolt Holes[1]	Length of Bolts[2,4]	Size of Ring Gasket
1	4 7/8	11/16	2 11/16	3 1/2	4	5/8	3/4	2 1/4	1 by 2 7/8
1 1/4	5 1/4	3/4	3 1/16	3 7/8	4	5/8	3/4	2 1/2	1 1/4 by 3 1/4
1 1/2	6 1/8	13/16	3 9/16	4 1/2	4	3/4	7/8	2 1/2	1 1/2 by 3 3/4
2	6 1/2	7/8	4 3/16	5	8	5/8	3/4	2 1/2	2 by 4 3/8
2 1/2	7 1/2	1	4 15/16	5 7/8	8	3/4	7/8	3	2 1/2 by 5 1/8
3	8 1/4	1 1/8	5 11/16	6 5/8	8	3/4	7/8	3 1/4	3 by 5 7/8
3 1/2	9	1 3/16	6 5/16	7 1/4	8	3/4	7/8	3 1/4	3 1/2 by 6 1/2
4	10	1 1/4	6 15/16	7 7/8	8	3/4	7/8	3 1/2	4 by 7 1/8
5	11	1 3/8	8 5/16	9 1/4	8	3/4	7/8	3 3/4	5 by 8 1/2
6	12 1/2	1 7/16	9 11/16	10 5/8	12	3/4	7/8	3 3/4	6 by 9 7/8
8	15	1 5/8	11 15/16	13	12	7/8	1	4 1/4	8 by 12 1/8
10	17 1/2	1 7/8	14 1/16	15 1/4	16	1	1 1/8	5	10 by 14 1/4
12	20 1/2	2	16 7/16	17 3/4	16	1 1/8	1 1/4	5 1/2	12 by 16 5/8
14 O.D.	23	2 1/8	18 15/16	20 1/4	20	1 1/8	1 1/4	5 3/4	13 1/4 by 19 1/8
16 O.D.	25 1/2	2 1/4	21 1/16	22 1/2	20	1 1/4	1 3/8	6	15 1/4 by 21 1/4
18 O.D.	28	2 3/8	23 5/16	24 3/4	24	1 1/4	1 3/8	6 1/4	17 by 23 1/2
20 O.D.	30 1/2	2 1/2	25 9/16	27	24	1 1/4	1 3/8	6 1/2	19 by 25 3/4
24 O.D.	36	2 3/4	30 5/16	32	24	1 1/2	1 5/8	7 1/2	23 by 30 1/2
30 O.D.	43	3	37 3/16	39 1/4	28	1 3/4	2	8 1/4	29 by 37 1/2
36 O.D.	50	3 3/8	43 11/16	46	32	2	2 1/4	9 1/4	34 1/2 by 44
42 O.D.	57	3 11/16	50 7/16	52 3/4	36	2	2 1/4	9 3/4	40 1/4 by 50 3/4
48 O.D.	65	4	58 7/16	60 3/4	40	2	2 1/4	10 1/2	46 by 58 3/4

[1]The number of holes in drilling templets are in multiples of four, so that fittings may be made to face in any quarter. The bolt holes are to straddle the center line.

[2]The bolt holes on cast-iron flanged fittings are not spot-faced for ordinary service. When required, the fittings and flanges in sizes 36 inches and larger can be spot-faced or back-faced, so that standard length bolts can be used.

[3]All 250-pound cast-iron standard flanges have a 1/16-inch raised face. This raised face is included in the face to face, center to face, and minimum thickness of flange dimensions.

[4]For bolts 1 3/4 inches in diameter and larger, bolt studs with a nut on each end are recommended.

MACHINERY'S Data Sheet No. 158, New Series, July, 1929

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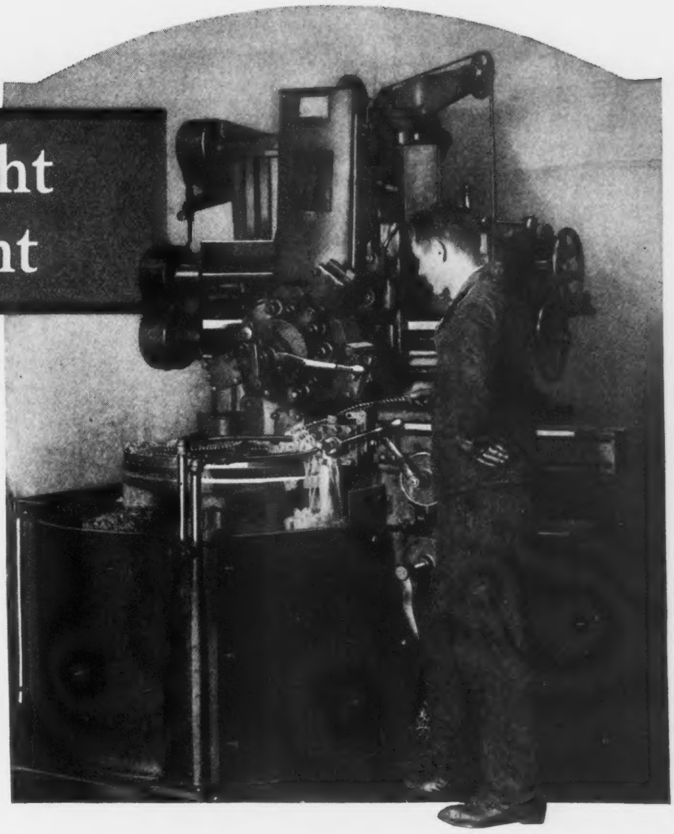
Selecting the Right Cutting Lubricant



Classification of Cutting Lubricants According to Characteristics, and Points to Consider in Selecting Them

By H. L. KAUFFMAN

CUTTING lubricants represent a class of products about which it is necessary to have certain specific information in order to get the best results from their use. It is the purpose of this article to give such practical information on this subject as will assist in the proper selection and economical use of the various cutting lubricants available. Perhaps it will be well to consider first what is meant by the term "cutting lubricants."

What are Cutting Lubricants?

Cutting lubricants are oils or emulsions used in metal-cutting operations to protect the tools and to reduce the temperature produced by the friction and shear at the point of tool contact. The term is a general one that is also applied to specific grades of cutting and soluble oils and cooling liquids. Based upon their composition, cutting lubricants may be divided into four main classes:

1. *Cutting oils* may be pure animal, vegetable, or mineral oils or they may be a mixture of animal or vegetable oil and a mineral oil. In any case, cutting oils are free from either water or soap, except as they may be contained as impurities.
2. *Water-soluble oils* are oily liquids that form an emulsion when mixed with water.
3. *Soluble compounds or cutting compounds* are greasy pastes that emulsify when mixed with water.
4. *Cutting emulsions* are aqueous emulsions formed by mixing soluble oils or soluble compounds with water in varying proportions.

General Requirements for Cutting Lubricants

All shop men know that it is impossible to obtain the desired finish in machining some materials without using the proper type and grade of cutting lubricant, and that the cutting speed, and therefore the rate of production, is influenced by the characteristics of the lubricant employed.

Few shop men, however, attempt to analyze the reasons back of the facts learned by experience. Consequently, when the quality of the work is impaired or the production rate is lessened due to the lubricant used, the superintendent or foreman is generally unable to correct the trouble immediately and must call for the services of an engineer of the company from whom the lubricant is purchased.

Let us now consider what the lubricant is required to do. As mentioned, it must aid in producing a smooth finish on the work. It must also furnish lubrication between the lip of the tool and the chip, reduce the temperature both of the tool and of the material being machined, flush out the cutting area, and protect the finished product from rust and corrosion.

With most materials, a smooth finish will be obtained when the cutting oil lubricates and cools the cutting surfaces properly. If a finish as nearly perfect as possible is desired, then oils possessing a high degree of oiliness or greasiness must be used. Consequently, when the finish is of major importance, animal or vegetable oils should be employed —either alone or compounded in a high percentage proportion with mineral oil. However, if a smooth action is given to the tool by the application to the cutting surfaces of a continuous stream of the proper grade of cutting lubricant, chatter and uneven strain upon the work will be prevented—in consequence of which, on most materials, the finish will be entirely satisfactory.

Reducing Cutting Friction

A cutting lubricant must reduce friction, in order to lessen the amount of heat generated and reduce the power required for the cutting operation by providing adequate lubrication between the lip of the tool and the chip. When the product being machined is a brittle granular material that is removed in the form of a powder or fine chips which do not tend to clog the cutting edge, lubrication is usually of little importance.

However, when the metal is tough and forms continuous spiral shavings, causing much frictional

heat as the shavings cling to the tool and rub over its faces, then lubrication is very important. As a matter of fact, the tougher the material the greater is the need for adequate lubrication. With improper or inadequate lubrication at the nose of the tool, the shavings produce so much frictional heat that the life of the cutting tool is lessened and a rough finish is produced.

Cooling Properties of a Lubricant

To prove satisfactory, a cutting lubricant must also possess cooling properties, that is, it must be able to reduce the temperature both of the tool and of the work being machined. Considerable frictional heat is generated when metal is cut by the separation of the chip from the main body of the metal, by "crimping" of the chip, and by the slipping of the metal chip over the face of the tool.

Excessive frictional heat causes errors in the dimensions of the finished product when measurements are taken on the heated material, and also results in more rapid wearing and dulling of the sharp cutting edge, in consequence of which, production is lessened and operating costs are increased because of the time and labor required for regrinding the cutting tools. Thus, it is obvious why the cooling properties of a cutting lubricant must be such as to meet requirements.

Washing or Flushing Effect of Lubricant

To assist in carrying away the chips, shavings, and other particles that may be detached by the tool during the operation—or, in other words, to flush out the cutting area and to free it from small metal particles—is another function of a cutting lubricant. This must be done as efficiently as possible in order to prevent excessive wear on the tool and maintain a satisfactory finish on the work. Removal of fine chips by the lubricant is especially important when deep holes are being drilled or in milling operations of a character that would affect the efficiency of the cutting tool and score the finished surface if chips and dust were allowed to accumulate.

Rusting and corrosion of metal surfaces can usually be avoided if the proper grade of cutting lubricant is used. Rusting is likely to develop only when a poor grade or a very dilute water solution of soluble oil or cutting compound is employed.

Straight Cutting Oils

The so-called "straight" cutting oils may be classified as follows:

1. Pure vegetable oils, such as cottonseed oil, rapeseed, or castor oil.
2. Pure animal oils, such as lard oil, tallow oil, sperm oil or whale oil.
3. Pure, straight mineral oils of relatively low viscosity.
4. Mineral oils that are compounded in various percentage proportions with other animal or vegetable oils.

Characteristics of Vegetable Oils

It is the degree of greasiness possessed by vegetable oils that makes them superior to either animal or mineral oils as cutting lubricants. The fact that vegetable oils oxidize and form gummy deposits more readily than either the animal or mineral oils, however, prevents them from being well adapted for use in circulating systems. This is because the deposits thus formed would clog the circulating system and interfere with the productivity of the machine.

The use of vegetable oils is especially advantageous in machining operations where a high degree of finish is desired. Because of their relatively high viscosity, vegetable oils are not very suitable as coolants when used in their pure state; consequently, on high-speed machining operations, they are usually compounded with mineral oils of low viscosity. Vegetable oils can often be used satisfactorily as cutting lubricants after having been mixed with water in order to form an emulsion.

A cutting oil performs four functions—it aids in producing a smooth finish on the work, it furnishes a lubricant between the lip of the tool and the chip, it reduces the temperature of both the tool and the material being machined, and it frequently carries away the chips from the cutting point of the tool. Most cutting oils that properly lubricate and cool the cutting surfaces also aid in producing a smooth finish; but quite different qualities are required in the cutting oil according to whether the lubricating property or the cooling quality is of greater importance.

Characteristics of Animal Oils

Animal oils are slightly less "greasy" than vegetable oils, but have the advantage of being lower in viscosity; because of the fluidity of most of them, in addition to their other desirable properties, they are excellent coolants for high-speed work. Lard oil is the most commonly used animal oil, being employed either in its pure form or compounded with a mineral oil. Either prime lard oil or extra No. 1 lard oil is purchased and used for this purpose, the former being the better grade of oil.

Prime lard oil is nearly colorless, having only a faint yellow or green tinge. The cheaper grades are more heavily colored, contain a larger percentage of free fatty acids, and therefore tend to decompose more rapidly than prime lard oil. Because of its oiliness, lard oil is a very suitable lubricant for use in machining tough materials, such as steel, or in cases where a high degree of finish is desired. However, all lard oils are somewhat deficient in cooling properties (as compared with oils that do not thicken when cooled and chilled), but even so, lard oil is superior to most straight mineral oils in its cooling properties.

Advantages Gained by Mixing Oils

While it is true that mineral oils are sometimes used alone as cutting lubricants, the results obtained are not generally as satisfactory as when such oils are first compounded with varying proportions of fatty oils. However, when pure mineral oils are employed for this purpose, they should be of relatively low viscosity (100 to 200 seconds Saybolt Universal viscometer) and yet be free from the presence of volatile constituents that would

result in objectionable smoking and fuming when the oil is exposed to the heat of the tool.

Compounding Animal and Mineral Oil

Compounding lard, or other fatty oils, with mineral oil, in percentages varying from 5 to 40 is the common method of making a "straight" cutting lubricant. The exact percentage proportion employed is determined by the nature of the material being machined, the cutting speed, depth of cut, method of circulating and supplying the lubricant to the tools, and similar factors.

The use of such cutting lubricants also minimizes the objectionable features in animal or vegetable oils; further, fatty acids, which are present in most fatty oils and which develop in additional amounts when the oil is exposed to temperatures attained during operations, will pit and attack the metal surfaces — especially in the presence of moisture—if the oil is allowed to remain in contact with the metal for an appreciable length of time.

After a fatty oil has been used a number of times, as in circulating systems, the oil deteriorates in value as a lubricant, and to an even greater degree as a coolant. Moreover, all fatty oils are very expensive if they are used alone.

Water-soluble Oils

Water-soluble oils are generally either of the soap-base type or of the sulphonated-oil type. The oil is mixed with water in varying proportions, depending upon operating conditions, to form a cutting emulsion. Such oil-water emulsions are much more effective in cooling the tool and the work, and are much less expensive, volume for volume, than the types of cutting lubricants previously mentioned.

These emulsions will also carry chips and metallic particles away from the point of tool contact better than any other type of lubricant. Water-soluble oil should generally be selected and used in the form of a cutting emulsion, for operations where conducting the heat away from the work is of primary importance.

Water-soluble cutting lubricants of good quality are free from disagreeable odors, mineral acids, and ingredients that are injurious to the hands of the workmen. They should form a suitable emulsion when mixed with water, should be free from corrosive action on polished metal, and should show no tendency to leave a sticky residue.

Soluble Compounds

Soluble compounds, also known as cutting compounds, are similar to water-soluble oils in that both will form an emulsion when mixed with water; but they differ in that the soluble compounds are made in the form of a paste instead of a liquid. As mentioned, cutting compounds are usually in a semi-emulsified condition, and contain from 10 to 70 per cent of water. The only use for which they can be especially recommended is on large rough work, and particularly when portable tools are used, where the cost and the difficulty of application are the main objections to the use of a lubricant in liquid form; or where cheapness of the cutting lubricant is a primary factor.

In selecting the most suitable cutting lubricant, the cutting speed and the depth of cut must be taken into consideration. When a deep cut is taken at a low speed, the important factor is the lubricating quality, and a cutting lubricant of great oiliness, such as a compounded mineral oil, should be used. When a light cut is taken at a low speed, neither great lubrication nor cooling qualities are necessary, and a cutting oil of low viscosity will be satisfactory. If the cut is light but the cutting speed high, a cutting lubricant with good cooling properties, such as a water-soluble oil-emulsion, is generally preferred; and when the cut is deep and the speed high, both cooling and lubricating qualities are required. In that case, a light mineral oil compounded with an animal oil, such as lard oil, would be selected.

Selecting Cutting Lubricants to Suit Cutting Speed and Depth of Cut

In order to select the proper cutting lubricant, the cutting speed and depth of cut must be taken into consideration. With a deep cut and a low speed, the important factor is lubrication, and a cutting lubricant possessing great oiliness, such as a compounded mineral oil should be used. When a light cut is being taken and the tool speed is low, but little coolant and little lubrication are required, and therefore, a cutting oil of low viscosity will suffice.

Where the cut is light and the cutting speed high, a large amount of heat is generated; consequently, a cutting medium with great cooling properties, such as a water-soluble oil emulsion, is generally to be preferred. When the cut is deep and the speed is high, both cooling and lubricating qualities are required. Under such conditions, a light mineral oil that will cool the work, compounded in large proportions with an animal oil which has good lubricating qualities should be selected.

Application of Water-emulsifiable Cutting Oil

In facing and turning a 0.70 to 0.90 per cent manganese steel ring gear blank on a 42-inch vertical turret lathe, as shown in the heading illustration, a water-emulsifiable cutting oil is used with good results. The roughing cuts are taken at a feed of 0.032 inch per revolution and at a surface speed of 60 feet per minute, with both the main head and the side head working simultaneously.

Application of Water-soluble Cutting Emulsion

A water-soluble cutting emulsion is used to advantage in machining a chrome-nickel steel gear blank having a bevel face. This operation is performed on a 24-inch vertical turret lathe. The side head tool is ground to form the bevel, and the sweep cuts are taken at a very light feed of 0.014 inch and at a surface speed of 50 feet per minute. The roughing cut taken by a tool in the main head, however, removes chips up to 1/16 inch thick.

Another example of the efficient use of a water-soluble cutting emulsion is the machining of a bronze worm-gear blank in a 12-inch Mult-Au-Matic. The machining operations on this part consist of boring, facing, chamfering, and forming the contour of the face of the teeth with a circular

forming tool which is fed in from the outside. The straight facing cut is taken slowly at a feed of 0.003 inch per revolution and at a surface speed of 40 feet per minute. The roughing cut, however, is taken at a feed of 0.031 inch per revolution. The material in this case is a tough manganese bronze.

For pipe-threading and cutting-off operations on a 16-inch Landis machine, excellent results are obtained by using a soluble oil of the sulphonated-base type. With this cutting lubricant, the resulting threads are smooth and well formed. These examples are given simply to indicate typical applications of commonly used cutting lubricants.

* * *

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

June 17, 1929

Little change has been apparent during the past month in the situation as a whole in the British metal-working industries. The steady progress that has characterized the earlier months of the present year appears to have been maintained, and it is too early yet to forecast what effect the accession to power of a Socialist Government is likely to have on industry.

Attention is Focussed on Exhibit of Machinery Importers' Association

The interest of machine tool users is focussed at present on the exhibition of machine tools being staged in London in connection with the International Foundry Trades Exhibition by the Machinery (Machine Tool and Woodworking) Importers' Association of Great Britain. It may be well to explain here that this association has been called into being largely as a result of the fact that German machine tools may not be exhibited at the quadrennial exhibition held by the Machine Tool Trades Association at Olympia.

As is only to be expected under the circumstances, the present exhibition is confined largely to German machine tools, although it must be understood that all imported machine tools, and also machines of British manufacture, are eligible for exhibition. The chief interest of the exhibition lies in the fact that many of the German machine tools to be exhibited have never before been publicly shown in this country, while the exhibition may certainly claim to be the first ever held here that is at all representative of the German machine tool industry.

British machine tool makers are, on the whole, well employed. During the last six months the volume of orders has been sustained at a good level, and, particularly in the northern districts, there have been signs of further expansion during recent weeks. Many firms have more orders on their books than at any time since the post-war boom, and these works will be fully employed on present bookings for periods varying from three to six months.

Among various classes of machine tools for which an especially keen demand is noted at present, mention may be made of drilling and boring machines; planing, shaping, and slotting machines; gear planing machines; and planer type milling machines. In the Sheffield district small tool makers report that trade is improving, manufacturers of milling cutters and high speed twist drills being especially busy.

Imports and Exports of Machine Tools Increase

The returns for April show a rise in both tonnage and value for imports and exports of machine tools. Considering exports first, we find that the tonnage exported during April totalled 1507, as compared with 1227 tons in March. The values of exports for the two months were £195,489 and £153,417, respectively.

Imports of machine tools during April totalled 885 tons, as compared with 800 tons in March, the corresponding values being £148,096 and £135,207. The ton value of imports during April was still substantially above the corresponding export figure, although the disparity was not quite so great as during the preceding month. The actual ton values of exports during the months of April and March, were £130 and £125, the import ton values being £167 and £169, respectively.

Exports of tools and cutters, estimated on a value basis, have shown a very slight but steady fall during the last three months. The April exports were valued at £47,360, as compared with £47,646 in March and £47,712 in February, the figures being notable chiefly for their consistency.

As regards the distribution of exported machine tools, the returns continue to indicate that the increase in trade is almost entirely with foreign countries, the position with regard to Empire markets remaining substantially unchanged.

British Steelwork Association is Formed

Structural engineers, in conjunction with steelmakers engaged in the rolling of structural steel, have recently formed the British Steelwork Association, the object of which is, by means of publicity and research, to promote an increased use of steel. The association, which will be non-profit-earning, will operate on similar lines to the organizations that have existed in other trades for a considerable time.

Electrical Engineering and Shipbuilding

Electrical engineering firms remain, on the whole, well employed, and some important contracts have been placed during recent weeks. Among these mention may be made of orders allocated by the Central Electricity Board in connection with the schemes for Southeast England, Central England, Northwest England, and Northern Wales, the total value of which is approximately £300,000.

In the shipbuilding industry, and more particularly in the Scottish yards, there has been a marked scarcity of orders. Various explanations have been advanced to account for the lack of new business; thus in some quarters it was stated that owing to the imminence of the General Election, shipowners would not invest more capital in new tonnage until the results became known. Shipbuilders, on the other hand, were of the opinion that the advance of 5 shillings per ton in the price of plates and sections, together with the uncertainty regarding wages, were to blame, necessitating, as they did, higher bids.

New Machinery and Shop Equipment

A Monthly Record of New Metal-working Machinery, Tools, and Devices for Increasing Manufacturing Efficiency and Reducing Costs

"FASTERMATIC" CHUCKING MACHINE

An automatic chucking machine in which the feeding mechanism that controls the movements of the tool-carrying units is entirely gearless is being placed on the market by the Foster Machine Co., Elkhart, Ind. This machine, known as the "Fastermatic," is built in platen and automatic-indexing turret types, each type being manufactured in four sizes having a swing over the bed of 17, 22, 25 1/2, and 33 inches, respectively.

All feeds are obtained by forcing oil into a hydraulic cylinder through the use of an Oilgear control pump which is located at the head end of the machine and driven by a silent chain from the main drive shaft. During the feeding period, a constant oil pressure is maintained on each side of the piston enclosed in the cylinder, and therefore, a back pressure exists on the side of the piston opposite to that on which the feeding pressure is applied. Uniform feeding of the tooling is thus insured when cuts are intermittent or of irregular depth.

The feeding movements of the tool-carrying units range from 0 to approximately 40 inches per minute. Feed changes are effected by varying the capacity of the pump and its delivery of oil to the cylinder. Cams, which may be quickly adjusted, provide for obtaining the desired feed and automatically maintaining it.

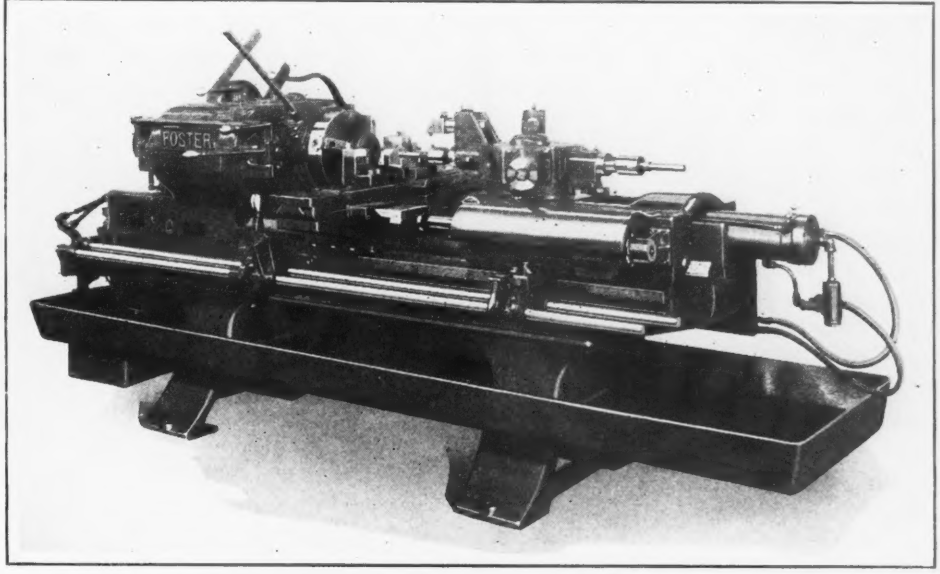


Fig. 2. Indexing-turret Type of "Fastermatic" also Built by the Foster Machine Co.

Return of the tooling from the work at the completion of all machining operations is automatically effected through a rapid traverse action of the cylinder. This rapid traverse is also employed to move the tooling quickly into position for beginning cuts, at which point the actual feeding movement begins. Upon the completion of an operation the tooling remains in the returned position until the feed is re-engaged by hand. The rapid traverse can be obtained automatically during any portion of the feeding movement. This greatly reduces the time on work having wide open spaces between turned or bored surfaces.

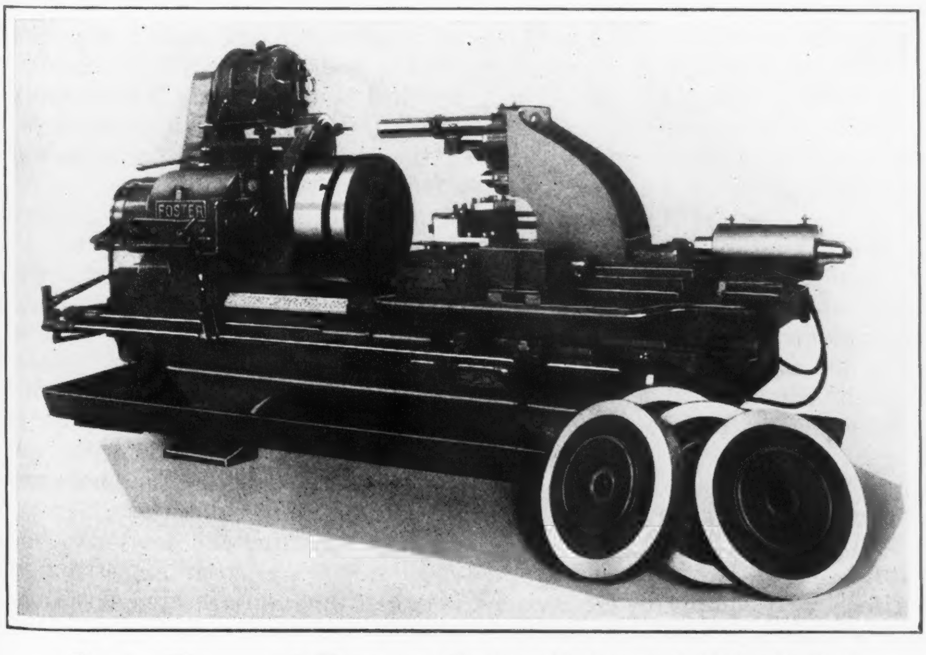


Fig. 1. "Fastermatic" Platen-type Chucking Machine with Hydraulic Feed

The features so far described are generally characteristic of both the platen and indexing-turret types of machines. There is, however, a wide distinction between the two. With the platen type, which is illustrated in Fig. 1, the tool-carrying units consist of a front and a rear cross-slide and a main slide, all of which are mounted on a platen. The latter, through the action of the cylinder, carries the tooling into

position for beginning the machining operations, and away from the work after the tooling units have receded to their original starting points. Ordinarily, the movements of the platen are rapid, but they are fully controllable and can be reduced to any rate required for feeding auxiliary tooling bolted to the platen for boring, forming, or turning operations.

With the indexing-turret type of "Fastermatic," which is shown in Fig. 2, the tool-carrying units consist of an automatically indexed hexagon turret and front and rear cross-slides. The cross-slides are mounted on a bridge which spans the bed, and are adjustable longitudinally. On this machine an oil cylinder located centrally between the ways of the bed at the rear effects the turret longitudinal movements. A rapid traverse brings the turret into position for starting boring and turning operations, and from this position the turret advances at a predetermined rate of feed.

These longitudinal movements are controlled by cams that regulate the volume of oil entering the cylinder. The cams, of which there is one for each turret face, are carried on a spool and index automatically in correct relation to the turret faces. Each cam is adjustable, making an independent feed readily available for each turret face. The turret can be made to remain fixed in any returned position. Also, the full travel back and forward may be performed without indexing. The turret is rigidly clamped before the tooling reaches the work and is released before indexing.

The cross-slides can be operated simultaneously or independently, and they can be timed to operate in conjunction with any one of the turret faces. Cross-movements are effected through the action of cams located beneath the slides and controlled by the movements of the turret. Provision is made for the use of overhead piloted tooling, as well as tooling piloted centrally.

Chucks such as are used on ordinary turret lathes are readily adaptable to these machines. Eight spindle speeds are available on the 1-F and 2-F machines, and twelve spindle speeds on the 3-F and 4-F machines. All these machines are equipped with Timken-bearing spindles, ball-bearing backshafts, and multiple-disk clutches.

DAVENPORT REDESIGNED AUTOMATIC SCREW MACHINE

The Davenport Machine Tool Co., 167 Ames St., Rochester, N. Y., has recently brought out a model B five-spindle automatic screw machine which, although based on the machine described in considerable detail in November, 1925, MACHINERY, page 241, constitutes a complete redesign. One of the important new features is that the two sets of cams that feed and return the tool-spindles and cross-slides are now assembled on sleeves, as shown in Fig. 2, so that all the cross-slide cams, or the tool-spindle cams, can be quickly inserted in the machine as one unit, or removed, as the case may be. Two sets of sleeves are furnished, so that when the machine is operating on jobbing work, cams to suit the next job can be assembled on sleeves ready to be substituted as soon as the work being performed has been completed.

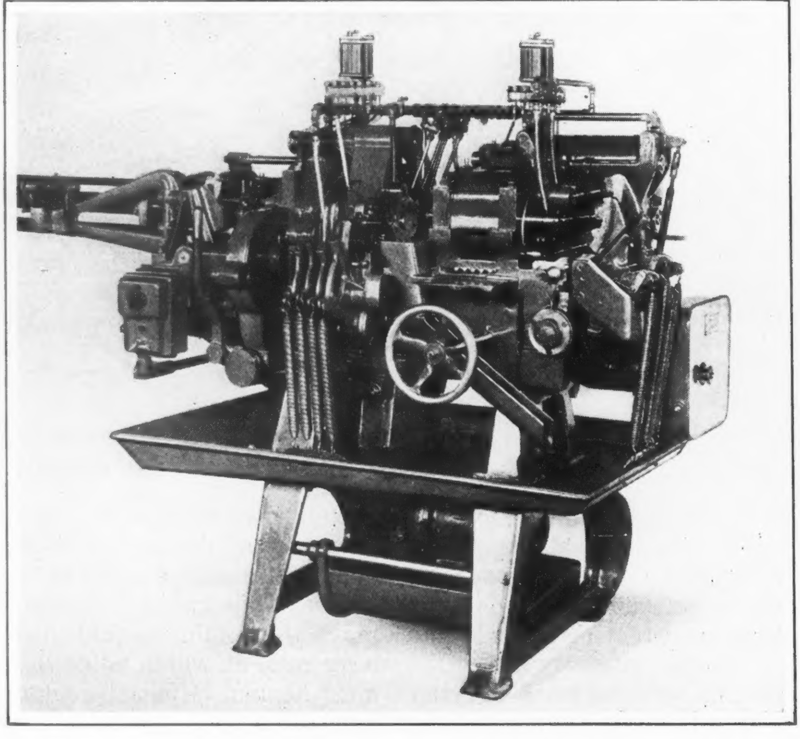


Fig. 1. Davenport Five-spindle Automatic Screw Machine which has Recently been Completely Redesigned

All cams for the cross-slides are now located at the front of the machine, as shown in Fig. 1, where they are far more convenient than in their former position at the back. Both camshafts run at one speed for one-half of each revolution, and at another speed for the remainder of each revolution. While the camshafts are turning at the faster speed, the tools are returned from the work, the work-head unit is unlocked, indexed, and relocked, and the stock is fed into the chuck that has been indexed into the loading position. During the slower speed of the camshafts, the tools are fed to the work.

Two large worm-wheels transmit the drive to the camshafts without backlash. The camshaft that actuates the tools of the tool-head is connected to the worm-wheel by a clutch. This construction enables the drive to the tool-head tools to be disengaged, so that in setting up the machine, the tool-spindles can be held in the withdrawn position while the cross-slide tools and the work-head are operated. Timken tapered roller bearings are provided for the index worm-shaft and the feed worm-shaft to take the radial and end thrusts.

The cam system controlling the cross-slide tools and the tool-head spindles is so arranged that the connections between the cam-operated levers and the spindles or slides are usually horizontal. When the connections are positioned at graduation No. 1

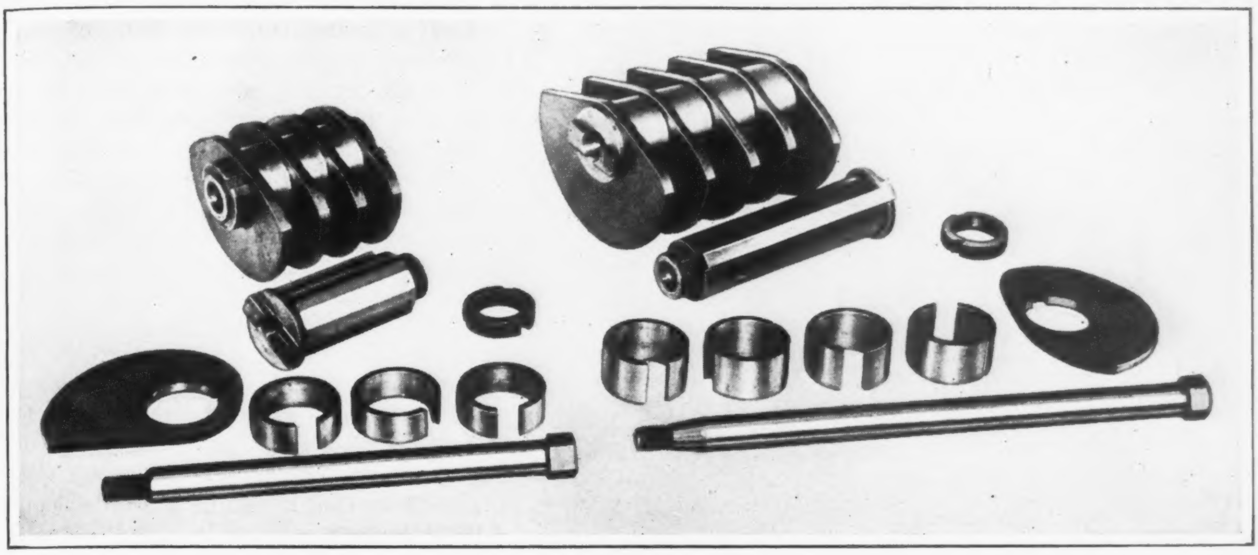


Fig. 2. Illustration Showing how the Cams that Control the Operation of the Cross-slides and Tool-spindles are Assembled into Units

on the levers, the movement of the tools is the same as the movement of their respective cams. By adjusting the connection block upward, the amount of feed is increased, and by adjusting the block downward, the feed is decreased.

Other improvements in the machine include a threading clutch of new design which can be employed in machining both brass and steel. Brass parts can be produced at rates up to sixty per minute, which necessitates 120 engagements and disengagements of the clutch per minute. At the extreme left of the work-head an outside support is provided, which eliminates overhang and any danger of the head wearing down into the bed, and also supports the case carrier. Indexing of the head is accomplished through a Geneva movement. Provision is made for quickly feeding the stock into the chucks through the medium of a rod which extends to the back end of the wire cases. Up to 3 inches of stock may be fed at a time, and the tools can turn up to 2 1/4 inches in length.

Renewable seats are furnished in the bed for the cross-slides, and the latter are of a longer design. The stops for the cross-slides are located on the slides and not on the toolposts, as formerly. The tool-spindles are hardened and ground, with a view to increasing their durability.

A conveyor of the construction shown in Fig. 3 can be furnished to carry the chips to the right-hand end of the bed and discharge them into a receptacle. This conveyor eliminates the delays occurring on some high-production jobs where it is necessary to stop the machine in order to remove the chips. The oil drains from the chips into the pan of the machine while the chips are being carried away by the conveyor. Provision is made for carrying the work-pieces, free from chips, to a receptacle at the right-hand end of the machine.

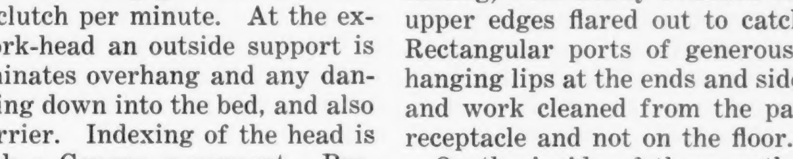


Fig. 3. Conveyor for Carrying away the Chips without Attention on the Part of the Operator

IMPROVED PAN FOR GRIDLEY AUTOMATICS

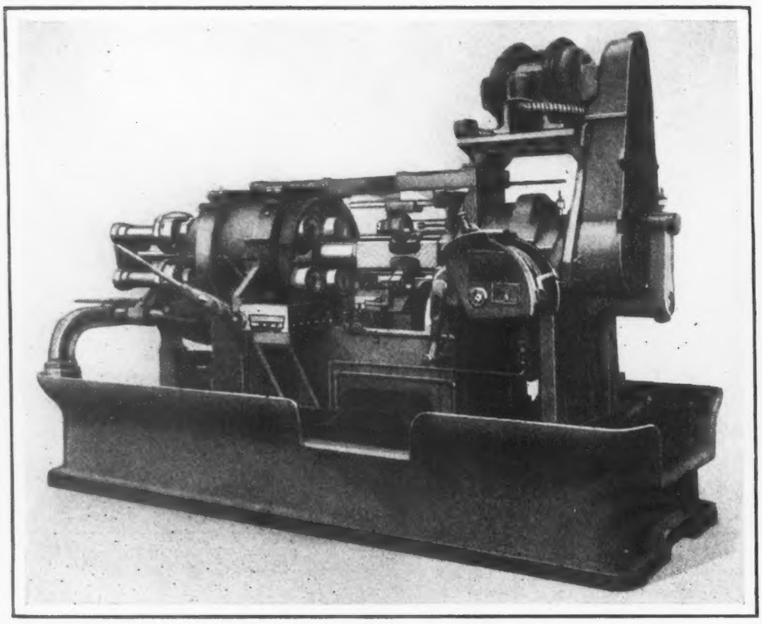
Large capacity for work, chips, cutting compound, and sludge, together with convenient means of cleaning from either end or side without interrupting the operation of the machine, are two important advantages of an improved pan or base now provided for the models G, GA, and H Gridley automatics built by the National Acme Co., Cleveland, Ohio. The new pan is a simple box-shaped casting, with neatly rounded corners and with the upper edges flared out to catch all chips and oil. Rectangular ports of generous size, having overhanging lips at the ends and sides, insure that chips and work cleaned from the pan will fall into the receptacle and not on the floor.

On the inside of the pan the ports merge with sloping ramps, which, in turn, merge with perforated plates that constitute a false bottom of large area on which the chips and work spread and through which the oil drains. The contents of the pan can be freely raked out in four directions, and one or more of the cleaning ports are always readily accessible even though the machines are grouped close together.

The new pan also provides a more substantial foundation for the mechanism. The increased weight and proper distribution of the metal neutralizes vibration from the machine and from the floor.

Below the false bottom of perforated plates, there is an oil reservoir which occupies the entire bottom of the pan. The large area of this reservoir insures that the oil, which comes hot from the cutting tools, will not be returned until it has thoroughly circulated about the reservoir and become cooled off.

Scale, fine chips, and abrasive substances settle out of the oil quickly while in this reservoir, because the oil is at no time in a state of agitation. There is ample room for the accumulation of sludge, and,



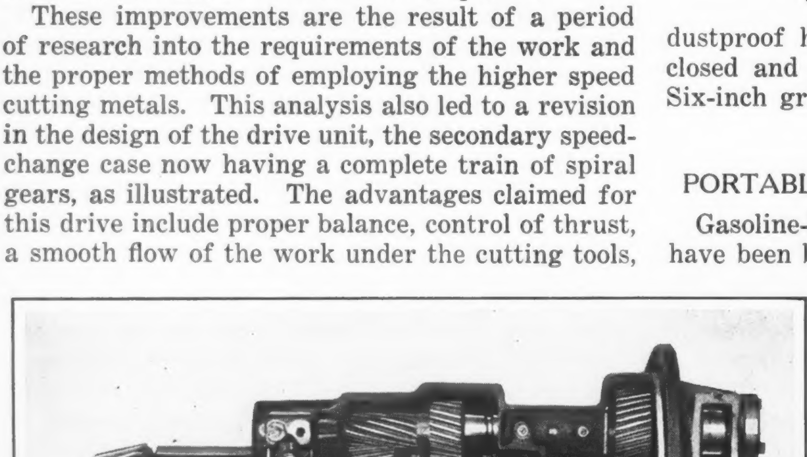
Gridley Automatic Equipped with Improved Pan or Base

therefore, frequent cleaning of the reservoir is not necessary. Sludge is hoed out through the cleaning ports after lifting the perforated plates.

BULLARD VERTICAL TURRET LATHES OF IMPROVED DESIGN

Vertical turret lathes of the "Spiral Drive" type, built by the Bullard Co., Bridgeport, Conn., have recently been improved to meet the demands of the latest cutting materials. The general appearance of these machines is the same as in the original design, illustrated and described in February, 1927, MACHINERY, page 472. However, the spindle speeds have been increased, and the recommended horsepower for motor drives has been selectively raised, with adequate strengthening in the construction of the various models of from 25 to 40 per cent.

These improvements are the result of a period of research into the requirements of the work and the proper methods of employing the higher speed cutting metals. This analysis also led to a revision in the design of the drive unit, the secondary speed-change case now having a complete train of spiral gears, as illustrated. The advantages claimed for this drive include proper balance, control of thrust, a smooth flow of the work under the cutting tools, and a more constant flow of power through the driving train to the table.



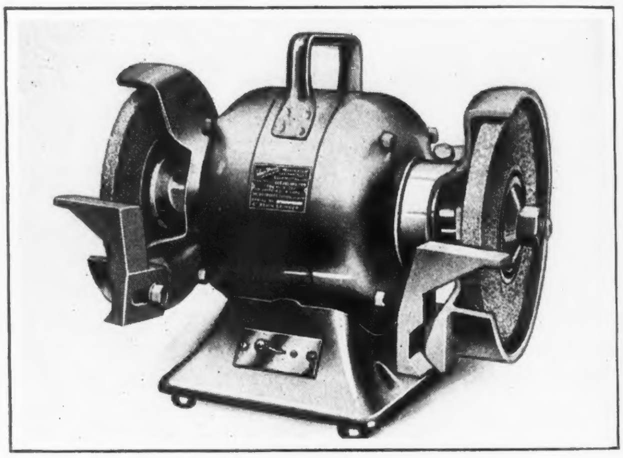
Spiral-gear Secondary Speed-gear Case now Provided on Bullard Vertical Turret Lathes

The secondary case, combined with the standard primary, provides variously eight and twelve different rates of speed. The new table speeds suit reasonable minimum diameters of work on which tungsten carbide and similar tools can be employed with maximum efficiency.

VAN DORN BENCH GRINDER

A 6-inch bench grinder, now being introduced to the trade by the Van Dorn Electric Tool Co., Cleveland, Ohio, weighs only 36 pounds and is equipped with a handle so that it can be moved with ease. This grinder is intended for the dressing of tools and light grinding of all kinds.

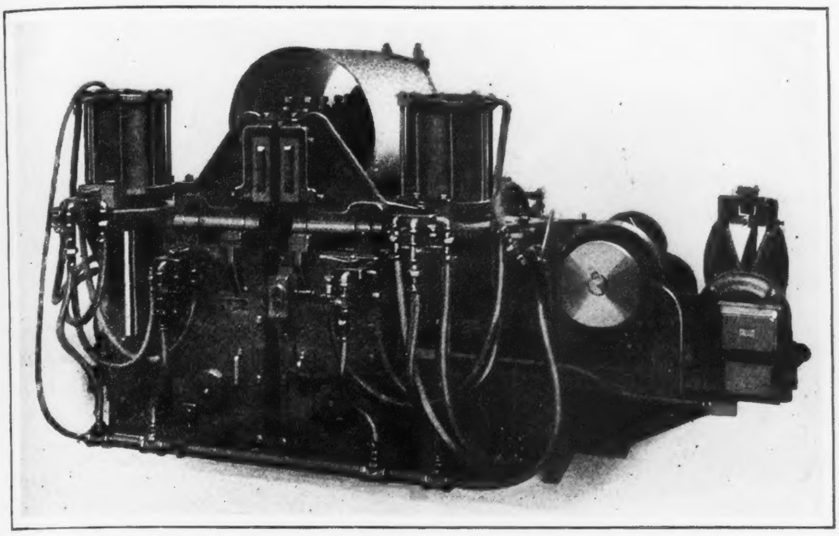
Rubber pads fitted on the base eliminate the necessity of bolting the grinder to a bench for light work. The shaft is mounted in ball bearings equipped with dustproof housings. The motor is completely enclosed and can be operated from a light circuit. Six-inch grinding wheels are furnished.



Van Dorn Portable Bench Grinder

PORTABLE GASOLINE-KEROSENE ENGINES

Gasoline-kerosene engines of new construction have been brought out by Fairbanks Morse & Co., Chicago, Ill., in ratings of from 1 1/2 to 7 1/2 horsepower. The 1 1/2-horsepower size is intended for a variety of applications, such as driving portable pumps and air compressors. It is less than 16 inches high, 22 inches long, and 19 inches wide, and weighs 150 pounds. There are two driving pulleys on the engine, one of which runs at the engine speed of 1500 revolutions per minute, and the other at 750 revolutions per minute. There is also a mechanical regulator by means of which the engine can be slowed down to 1100 revolutions per minute with a proportionate reduction in horsepower.



Federal Welder for Flash-butt Welding Seams of Barrels

FEDERAL FLASH-BUTT BARREL WELDER

A machine designed for flash-butt welding the side seams of barrels varying in length from 20 to 40 inches is a recent development of the Federal Machine & Welder Co., Dana Ave., Warren, Ohio. This machine is equipped with a regulating coil which permits different gages of metal from No. 10 to 22 or 24 to be welded. The equipment is an outgrowth of the automobile body welding machines built by the same concern.

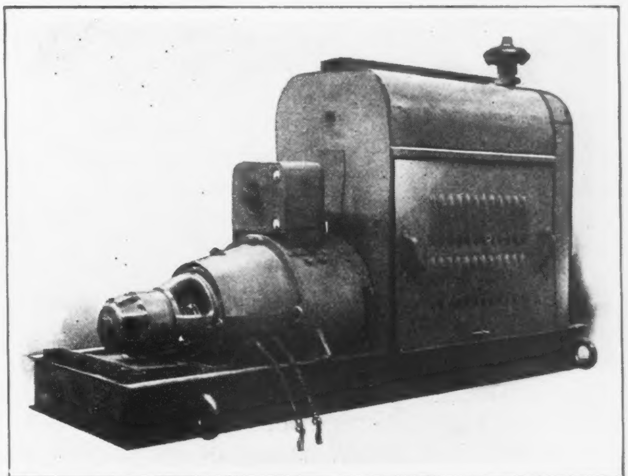
The clamps on the machine are so arranged that barrels as small as 14 1/2 inches in diameter can be accommodated, and there is no limit to the maximum diameter that can be clamped. There are two sets of clamps, one of which is used for gripping the work between the welding jaws, and the other for holding the arms in an open position, thus allowing the work to be easily put in place or removed. Production rates with this equipment range from 60 to 100 barrels per hour.

WESTINGHOUSE ARC-WELDING EQUIPMENT

Single-operator arc-welding generators of 300 and 400 amperes rating have recently been placed on the market by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., to round out its line of welding equipment. These special type SK generators are made in the belted and coupled design to be driven by electric motors, gasoline engines, tractors, lineshafting, etc. Speeds of 1750 and 1450 revolutions per minute, clockwise and counter-clockwise, provide ratings for every application. Each unit includes a generator, direct-connected exciter, control panel, and reactor. The control is mounted on the generator frame and enclosed by a sheet-metal cabinet.

The accompanying illustration shows a 300-ampere generator arranged to be driven by a gasoline engine. This set is intended primarily for supplying welding current where a local power supply is not available, as in the case of pipe line and storage tank construction, steam railroad construction, and maintenance work.

The power source of this set consists of a Continental model P-35 four-cylinder gasoline engine, direct-connected to the generator. The latter has



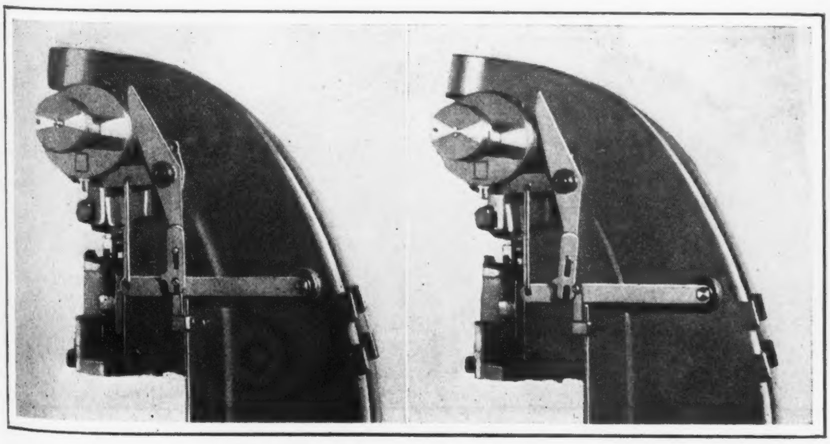
Westinghouse Arc-welding Set Driven by Gasoline Engine

a bracket which fits into the engine housing so as to make the equipment compact. The set can be made portable by the provision of running gear parts.

NON-REPEATING CLUTCH CONTROL FOR FEDERAL PRESSES

Power presses built by the Federal Press Co., Elkhart, Ind., may now be furnished with a clutch control mechanism that eliminates the possibility of a press repeating unless continuous operation is desired. This non-repeating clutch control will stop the ram action after one stroke, even when the trip-pedal is intentionally or unintentionally held down, and it requires full release of the trip-pedal before the ram will again function.

The simplicity of the mechanism is evident from the illustration, in which the view at the left shows the device set for operation. It will be seen that a cam on the clutch flange of the crankshaft operates



Federal Non-repeating Clutch Control Shown Engaged and Disengaged

a rocker arm and floating pin in a trip-bar. When continuous operation of a press is required, the non-repeating mechanism is easily disengaged by slipping a sliding joint ahead of the floating pin in the trip-bar, as shown in the right-hand view of the illustration. There are no screws or bolts to remove and no adjustments are necessary. A patent covers the application of this clutch control mechanism to power presses and equipment of a similar kind.

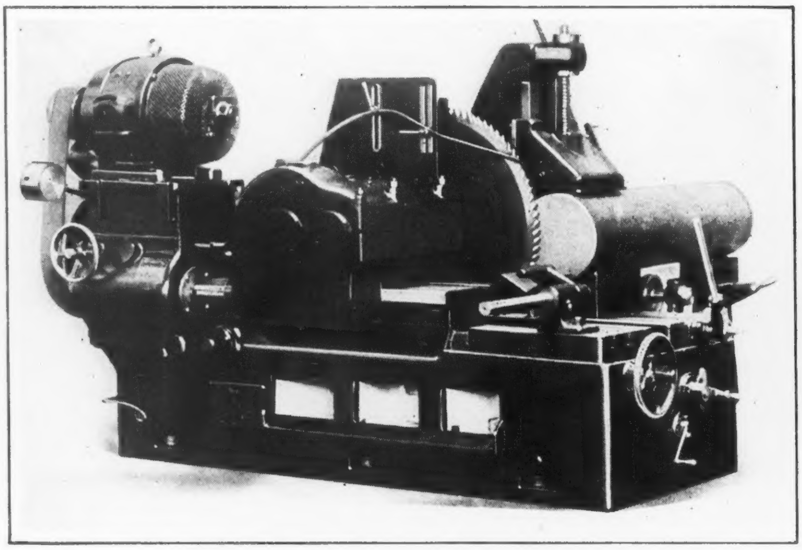


Fig. 1. Heller Cold Metal Saw Placed on the Market by the Steinle Turret Machine Co.

HELLER COLD METAL SAWS

Seven sizes of Heller "High Efficiency" metal cutting-off machines equipped with circular saws ranging from 10 to 52 inches in diameter for cutting stock from 1 3/4 to 20 inches in diameter are being introduced on the market by the Steinle Turret Machine Co., Madison, Wis. Fig. 1 shows the standard SS type of saw which will be described in this article; Fig. 2 shows a special type SSK saw for crankshaft cutting and similar work; Fig. 3 shows a special type LKS saw for frog and switch work; and Fig. 4 shows a special type SSQ saw for the straight and miter cutting of structural steel shapes.

The machines are of heavy-duty design. They are all-steel geared and are ball-bearing equipped. The final saw-arbor drive is through the medium of a worm-gear unit, of which the driven worm is one-half the diameter of the blade itself, and a two-to-one herringbone gear unit. The blade cuts the stock on the up motion, and hence the stress of the cut is downward from the saw carriage to the bed of the machine where it is absorbed without vibration.

Four blade speeds and five blade feeds are available through selective gearing, thus giving a flexibility of operation for various materials. The feeds are controlled from the operator's position at the front of the machine, and can be changed while the blade is under a cut. A flexible clutch acts as a safeguard against excessive pressure and thus prevents damage to the saw blade or machine in the event that the carriage should be run carelessly against the work. Adjustable feed-trips are provided, and upon the completion of a cut the blade carriage is automatically returned to the starting position by a quick power traverse.

The stock is fed mechanically to a stop by a roller arrangement which is brought into contact with the bar by exerting a slight pressure on the control lever. The free end of the bar is held on a roller carrier which travels on a narrow-gage track at right angles to the machine. Clamping of the stock is easily effected by a "hammer-type" clamping wheel which eliminates the necessity of a hard straight pull on the clamp.

The machine is driven through a single pulley direct to a change-gear box. With a motor drive, the motor is placed on top of the gear-box and drives through a belt having an idler pulley arrangement.

The blades furnished with the machine are of the Heller segmental type, being composed of a center disk of heat-treated steel of high tensile strength,

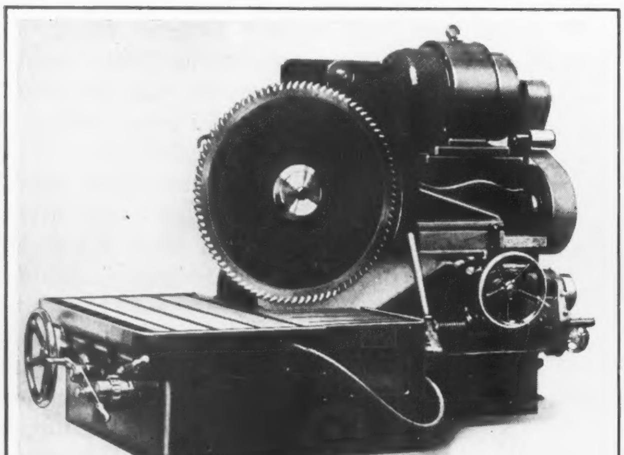


Fig. 2. Special Type of Sawing Machine for Crankshafts and Similar Work

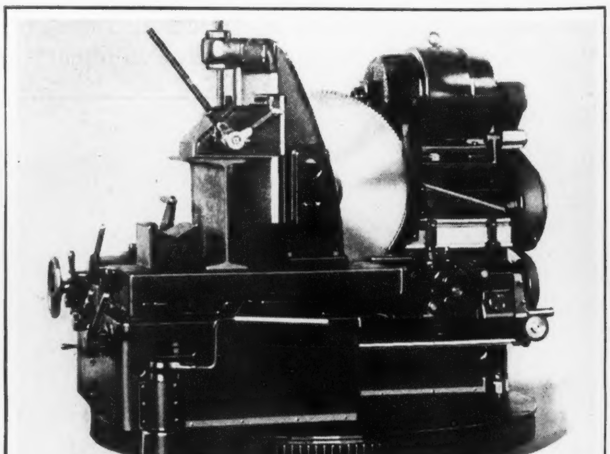


Fig. 3. Sawing Machine Designed Primarily for Frog and Switch Work

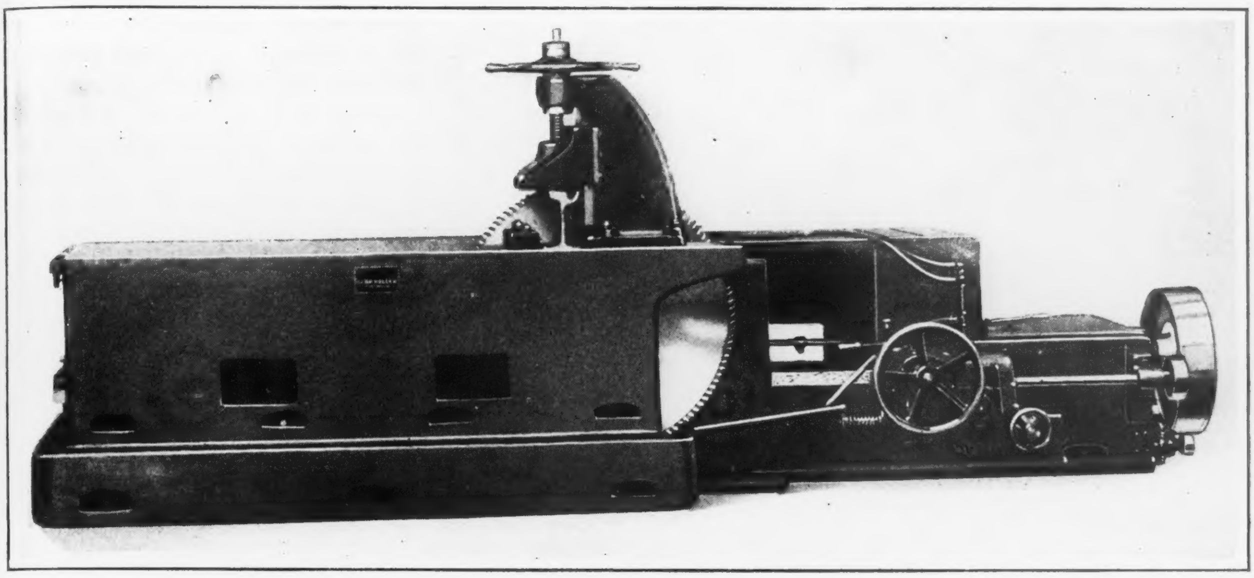


Fig. 4. Saw for Straight and Miter Cutting of Structural Steel Members

to the periphery of which high-speed steel segments are riveted. These segments are milled or slotted to fit the shoulder edge of the disk in such a manner that proper alignment is insured under the most severe cuts. Each segment comprises four cutting teeth, the teeth being alternately of the bevelled roughing type and square finishing type so that the chips are cut into three parts to relieve the strain at the point of the cut. A chip remover prevents adherence of the chips to the blade teeth after they pass through the cut. Full automatic grinders are built in three sizes for sharpening the blades.

A deep sump for coolant compound is built integral with the machine base. A pump furnishes a heavy flow of coolant to the blade. Standard sizes of these machines range in weight from 800 to 19,000 pounds.

BRADFORD THREE-WAY DRILLING MACHINE

Three self-contained drill heads are provided on a machine recently built by the Bradford Machine Tool Co., Cincinnati, Ohio, for drilling seven holes in cast-iron bodies of hydraulic shock absorbers. The machine is so arranged that the head at the left of the operator drills two 33/64-inch holes 17/32 inch deep and one 0.557-inch hole 1 13/16 inches deep. The right-hand head drills three 0.257-inch holes 9/16 inch deep, while the head mounted on the angular bracket at the back of the machine drills a 0.332-inch hole 1/4 inch deep. The floor-to-floor time per piece is 36 seconds. One boy can operate two machines.

Bradford Special Three-way Machine Arranged Primarily for Drilling Shock-absorber Bodies

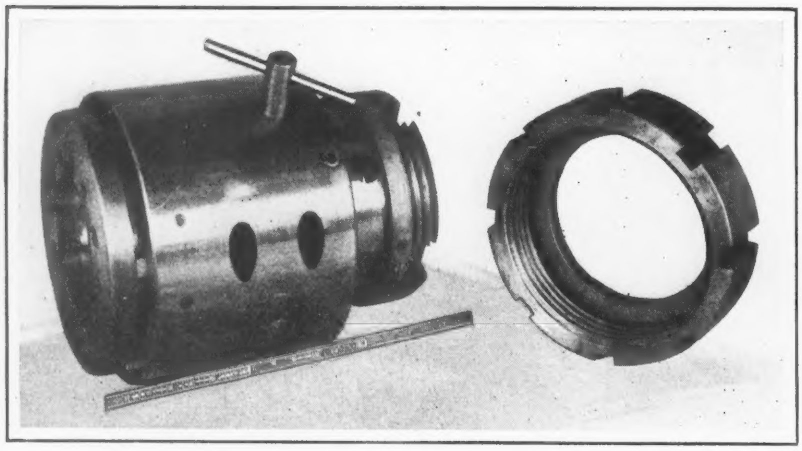
In running the machine, the operator clamps a part in the work-holding fixture and trips the feeding mechanism of the master head by lifting the lever at his right. A cam on this head controls the action of the tripping rods seen at the back of the fixture, which arrangement makes it possible to trip all heads simultaneously with a single motion. The action of all units is fully automatic, no attention being required from the operator after the feeding mechanism has been tripped. All motors are controlled through a single push-button.

Circular T-slots in the table facilitate rearrangement of the drilling units in case it is desired to rebuild the machine for other work.

DAVIS & THOMPSON SELF-OPENING DIE-HEAD

An automatic die-head has recently been brought out for use on the "Rotomatic" threading machine built by the Davis & Thompson Co., 57th Ave. and Mitchell St., Milwaukee, Wis. This die-head weighs 400 pounds and is 18 inches long. It is closed automatically through the operation of the machine, and an internal trip opens the dies when threads have been cut to the desired length.

Changing of the chasers in this die-head is accomplished by turning the T-handle wrench. The



Die-head for Davis "Rotomatic" Threading Machine

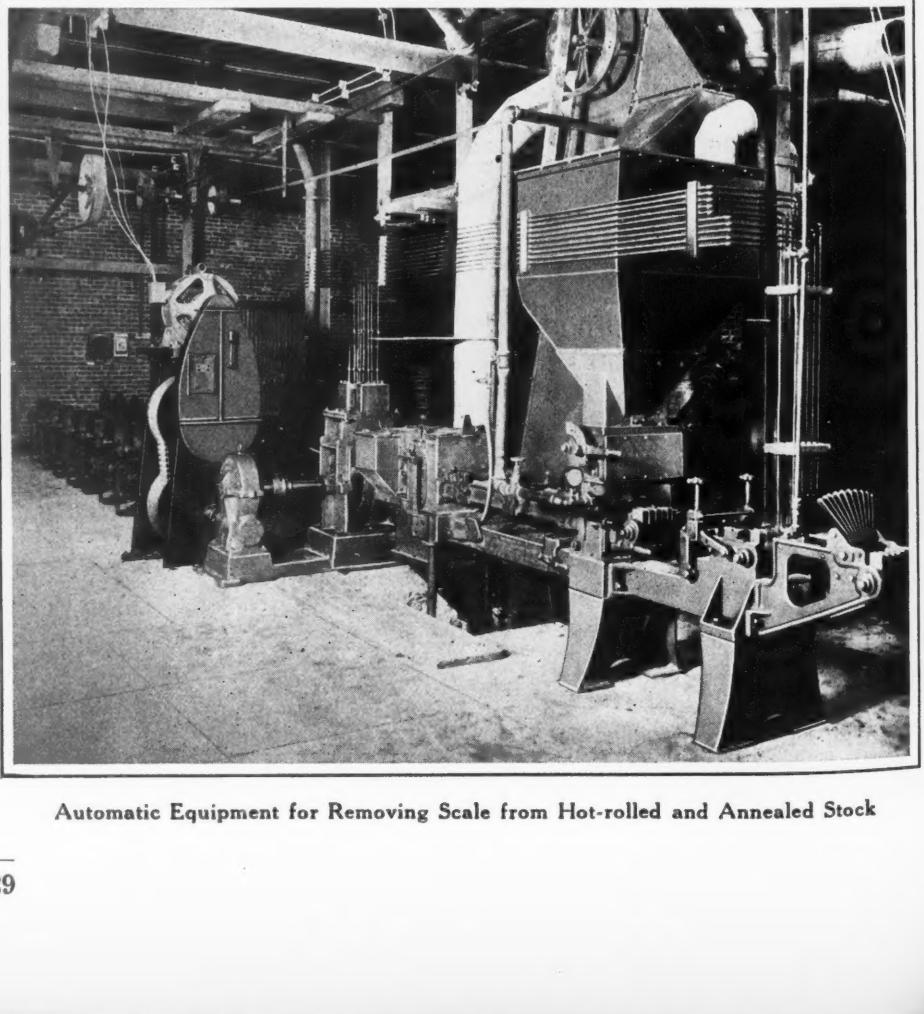
graduated dial near the under side of the die-head, as seen in the illustration, is marked to show the position of the chasers. Adjusting screws are located on each side of this dial, which is part of a worm-wheel having an eccentric pin on one end that operates the adjusting mechanism in feeding.

Six of these die-heads are used on the machine mentioned, which has a capacity for threading pipe from 2 to 4 inches in diameter.

ABRASIVE SCOURING MACHINE FOR CLEANING METAL

Automatic equipment employing abrasive or sand for removing scale from hot-rolled or annealed steel strips, sheets, rods, and wire has recently been developed by the Standard Equipment Co., 61-63 Foote St., New Haven, Conn. The accompanying illustration shows an installation at the Athenia Steel Co., Athenia-Clifton, N. J., which handles simultaneously from one to eight strips of steel up to 7 inches wide. Both the sides and edges of hot-rolled high-carbon steel are cleaned at the rate of from 35 to 45 feet per minute, while annealed and tempered stock is cleaned at the rate of from 40 to 60 feet per minute. The stock is fed but once through the machine.

At the extreme left of the illustration may be seen an eight-reel stock winder, driven by a Reeves variable-speed transmission which also furnishes power to the pulling rolls of the machine. Stock up to 0.125 inch thick can be pulled by the rolls at various speeds from 10 to 80 feet per minute. The pulling rolls are controlled by compressed air through the operation of levers within easy reach of the stock supply man at the front end of the machine. Individual levers grip or release the strips of stock.



Automatic Equipment for Removing Scale from Hot-rolled and Annealed Stock

Successive strips or coils of stock are welded to the ends of those going through the machine, so that the operation is continuous. Each winding drum or reel has a foot-lever clutch control, enabling finished coils of stock to be conveniently removed and new coils started. The abrasive or sand employed for cleaning is used over and over. Dust is removed by an exhaust system into a cloth screen arrester. Modifications of this equipment can be built for handling wider stock, rods, wire, etc.

MOLINE RADIATOR-LOOP BORING, FACING AND TAPPING MACHINES

Single-purpose machines designed for boring, facing, and tapping radiator loops or sections, have recently been built by the Moline Tool Co., Moline, Ill. These machines are provided with four spindles, as illustrated. All the spindles can be arranged for boring and facing operations or for facing and tapping operations, or half of them can be arranged for boring and the other half for tapping. Fig. 1 shows the front view of one of these machines arranged for facing and tapping, while Fig. 2 shows the rear view of a machine equipped for boring and facing. In the second illustration, the Oilgear feed equipment can be clearly seen.

The machines consist of a large bed with V-guides for two rails that carry the cutter-spindle units. These rails are gibbed and are actuated by hydraulic cylinders, a cylinder being provided for

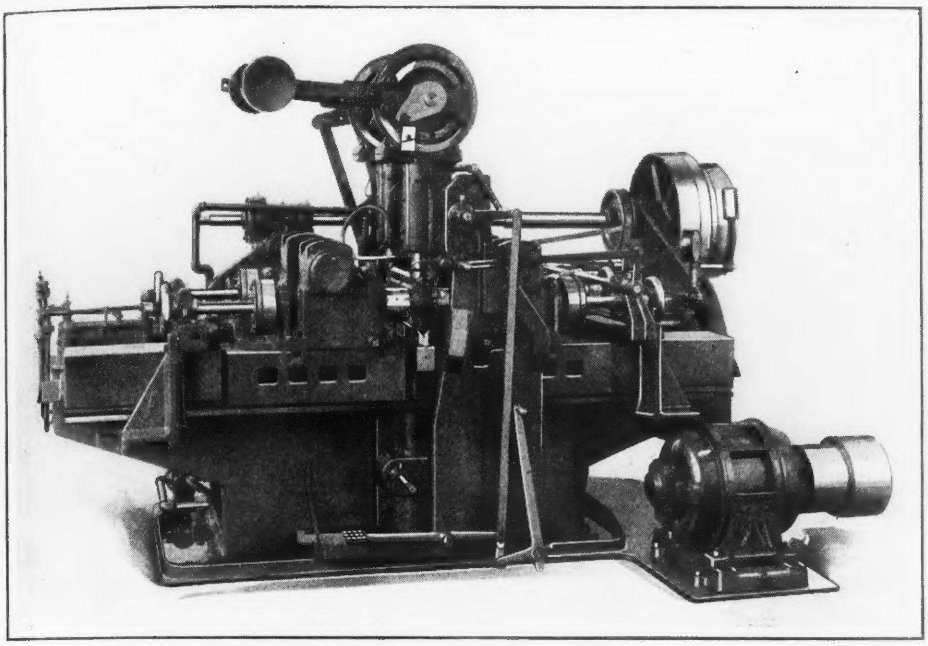


Fig. 1. Moline Radiator-loop Machine Arranged for Facing and Tapping

each rail. In order to insure the same amount of pressure on all tools, the two rails are connected through a rack and pinion. This arrangement equalizes their traverse, so that if one cylinder does not function properly, the other will operate both rails. All fast-running shafts and spindles are ball-bearing mounted, and the spindles are provided with an end adjustment for setting the tools in the correct relation to one another.

For boring and facing, the machine is equipped with three motors as shown in Fig. 2, there being a motor on each rail for driving two spindles each, and a third motor at the bottom of the machine for operating the Oilgear feed-pump. The main spindle drive is through Texrope belts and spiral gears.

In the center of both types of these machines, there is a work-holding fixture, as seen in Fig. 1, which consists primarily of an adjustable bar that carries V-block guides and a stop to insure proper setting of the work. Adjustments for various sizes of radiator loops are made by means of a gear and screw mechanism which is actuated through the square-end shaft seen directly above the foot-lever at the front of the machine. Two V-clamps are arranged over the holding fixture to grip the loops securely.

The operating cycle of the machine shown in Fig. 2 is as follows: With the spindles running, the operator inserts a loop casting in the fixture and steps on the foot-lever to bring the clamps into position through weights, after which the spindles feed to the proper depth, performing the boring operation and running against positive stops for the facing. When sufficient pressure has been built up in the hydraulic system, the flow of oil is automatically reversed to bring the tools back to the starting position. As soon as the tools clear the work, oil released from the pressure circuit flows to an auxiliary cylinder at the rear of the machine, raising the clamps from the work and thus completing the cycle. As quickly as the operator can remove the finished casting and insert another, the operation is repeated, an average production of 225 loops per hour being obtainable.

Advantages of increased production and safety are claimed for the hydraulic feed. If the tools become too dull or the work is put in the machine incorrectly, a pressure will be built up in the hydraulic system equal to that required for reversing the spindles, and the tools will be brought back to the starting position.

Rough castings are tapped and faced in one operation in the machine shown in Fig. 1, the cycle of the machine being almost identical with that described. However, the tapping is done by a mechanical feed through a screw and nut having the same lead as the tap. The facing is done with the hydraulic feed.

The facing cutters are mounted on the main spindles, while the taps are inserted in small spindles that operate through the center of the main spindles. The tap spindles are adjustable endwise, the same as the facing spindles. One motor, mounted on the base as shown, drives the machine through open and closed belts which keep the timing correct. The average production on this operation is 90 loops per hour.

Loops from 5 to 13 inches wide and from 8 to 38 inches long between the centers of the holes, can be

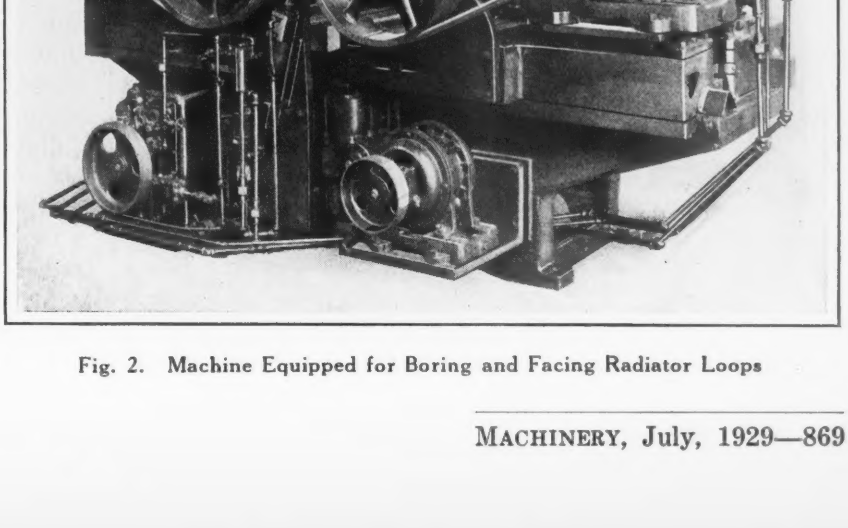


Fig. 2. Machine Equipped for Boring and Facing Radiator Loops

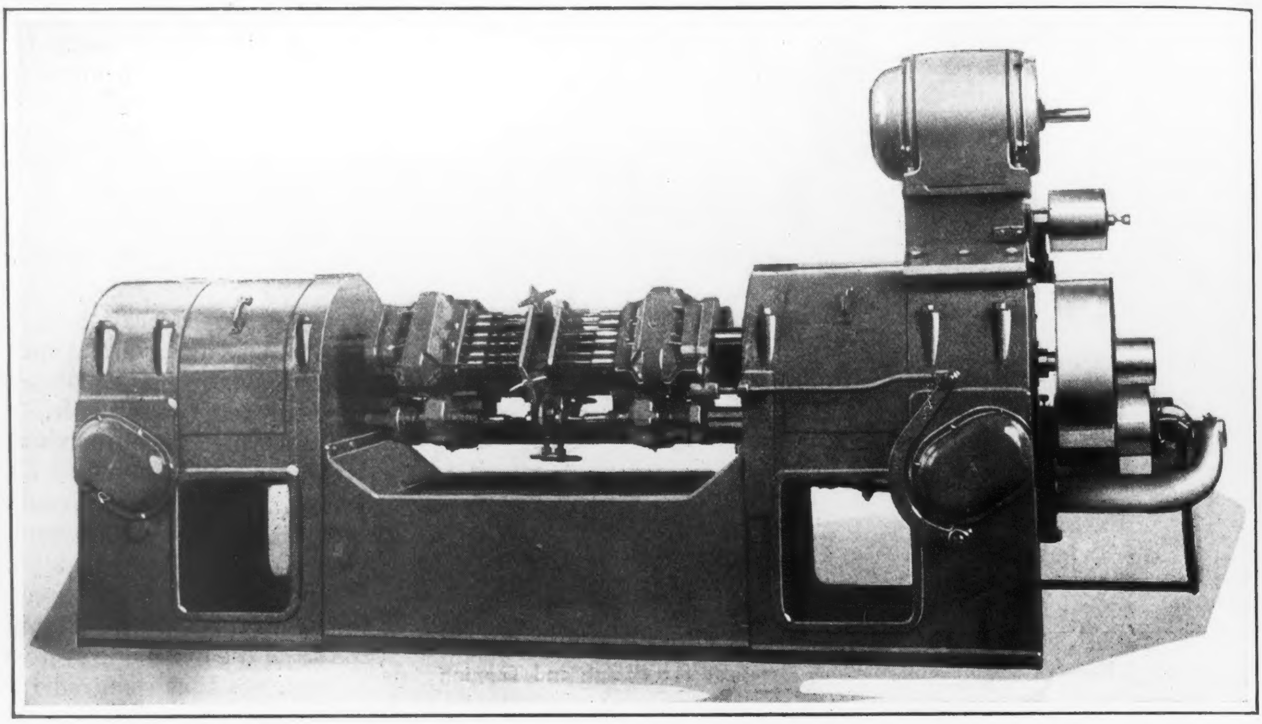


Fig. 1. Davis & Thompson Horizontal Machine Designed for Drilling and Reaming Automobile Push-rod Guides

handled in both machines. The approximate weight of the machine arranged for boring and facing is 15,000 pounds, and equipped for facing and tapping, 18,000 pounds.

DAVIS & THOMPSON HORIZONTAL DRILLING MACHINE WITH CRANK-DRIVEN SPINDLES

A double-end multiple-spindle type of machine recently built by the Davis & Thompson Co., 57th Ave. and Mitchell St., Milwaukee, Wis., for drilling and reaming push-rod guides for automobile engines, is shown in Fig. 1. This machine drills the parts from one side and reams them from the opposite side, the heads being fed by a cam in the machine housing.

One of the principal features of this machine is the method employed for driving the drill and reamer spindles, which are located so close together that a full gear drive would be impractical. From Fig. 2 it will be seen that each of these spindles has a crank portion and that all the cranks of one head are driven together by means of a member that connects them to one another. Power for driving the spindles of each head is delivered by a small pinion on the corresponding main spindle of the machine, which drives gears mounted at the left-hand end of the second spindle from the top, as seen in Fig. 2, and also at the left-hand end of the second spindle from the bottom.

To take care of the thrust on the drills, rings or collars are turned on the spindles. These collars come in contact with bearings which are threaded into the housing of the drill head for the full length, and in this way, the thrust is taken by the threads.

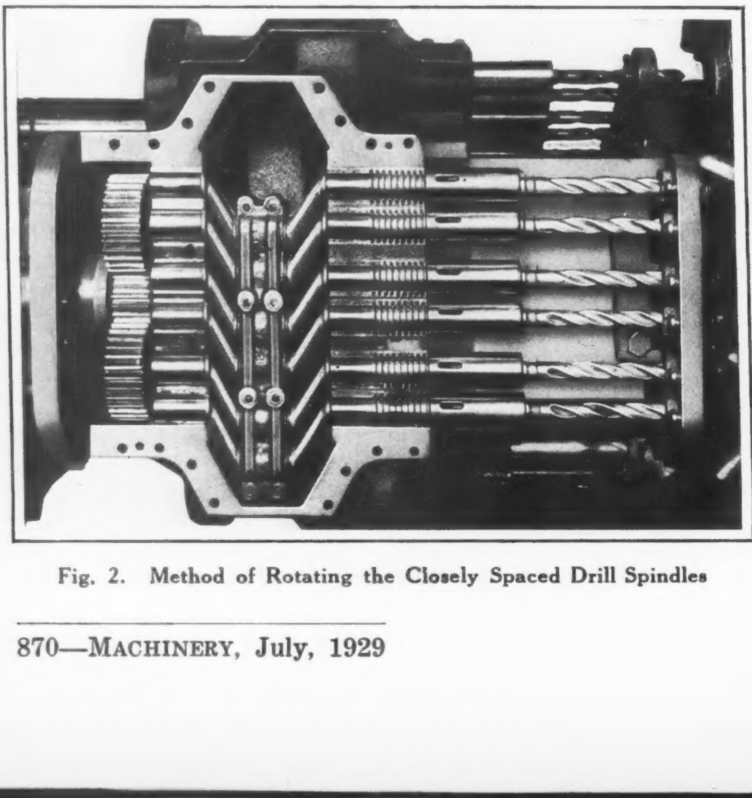


Fig. 2. Method of Rotating the Closely Spaced Drill Spindles

KEARNEY & TRECKER GEAR MILLING MACHINE

A special type of milling machine has recently been built by the Kearney & Trecker Corporation, Milwaukee, Wis., for rough-milling the teeth of differential gears and pinions for farm tractors. This machine is designed for operation on a quantity-production basis, having an output of eighteen gears and forty pinions per hour. Three high-carbon steel 28-tooth gears of 4–5 diametral pitch, and four 14-tooth pinions, are milled simultaneously. The machine can be adapted for cutting gears or pinions having different numbers of teeth or different pitch diameters by the provision of other fixtures. With the exception of loading the work-spindle, the machine is entirely automatic.

Primarily, the machine is a No. 1404 "Milwaukee-Mil Simplex," equipped with a two-spindle horizontal head and two opposed independently controlled cam-operated tables. Each table carries an automatic indexing fixture, one having three spindles for gears, and the other, four

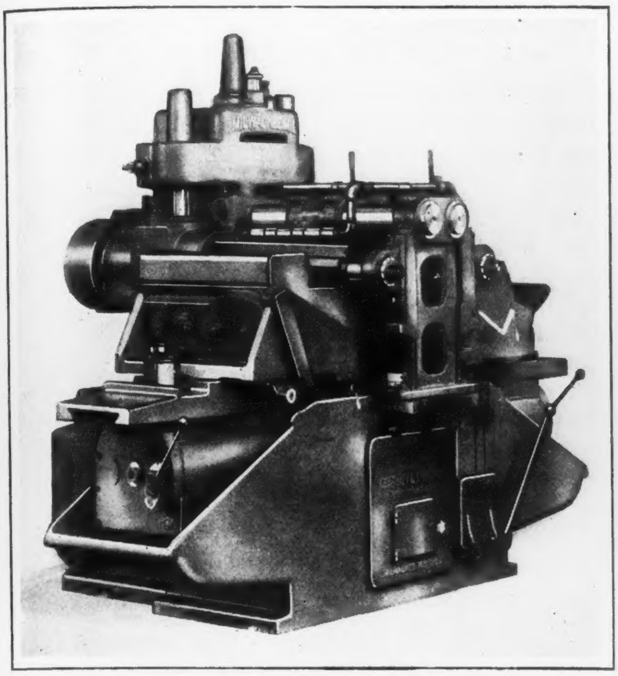


Fig. 1. Kearney & Trecker Milling Machine for Roughing the Teeth of Differential Gears

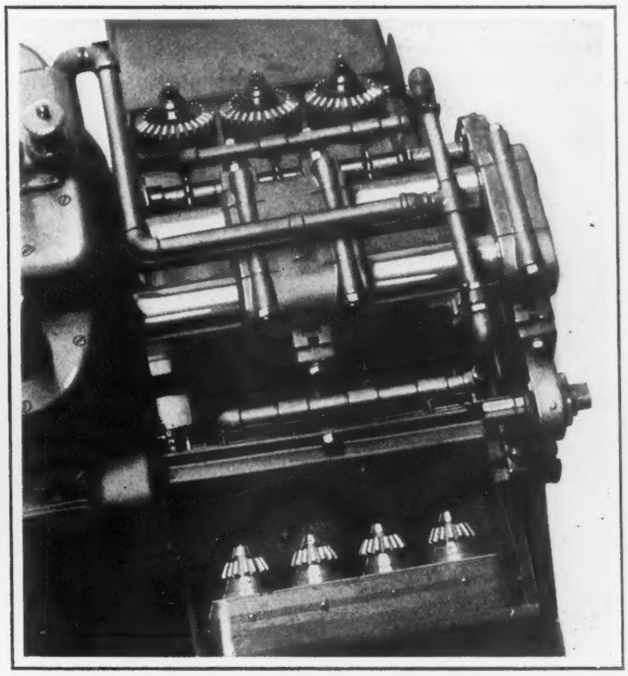


Fig. 2. Top View of the Work-spindles and Cutter-arbors on Gear Milling Machine

spindles for pinions, as shown in Fig. 2. There are two cutter-arbors, the one on the gear side carrying three bevel-gear roughing cutters, and the one on the pinion side, four cutters of the same type. The arbor spindles are mounted in Timken tapered roller bearings, the outer support bearings being so made that they may be slipped off the arbors without disturbing the over-arms or the front brace. Both the center-bearing support and that for the end bearing can be moved vertically to adjust the cutters in relation to the work. The arbors are fitted with sleeves which hold the cutters laterally and facilitate their replacement. The cutter-spindles revolve in opposite directions, turning in a direction against that of the feed.

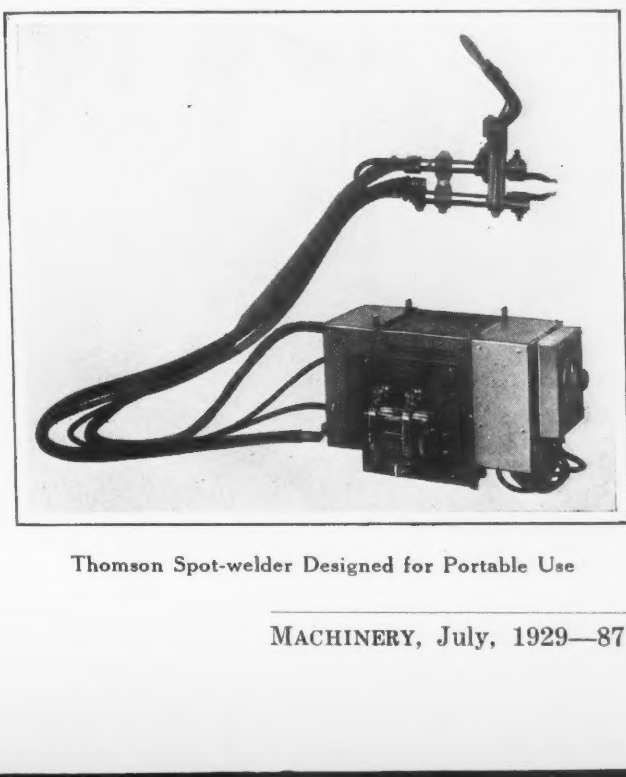
As the tables are independently controlled, either of them may be stopped at the end of the out stroke for changing work or cutters, without stopping the other. The cams and the work-spindles are also mounted in Timken tapered roller bearings. It is mentioned that the rigidity with which these bearings hold the spindles permits snug setting of the work without interfering with the free rolling motion necessary for automatic indexing. Each work-spindle is automatically locked in the indexed positions for the cuts. The arbors, work-tables, and index mechanism are driven by one motor through horizontal and vertical gear-reduction units.

In the operation of this machine, after either group of work-spindles has been loaded, the operator trips the starting lever at the outer end of the table to start the table movements. The work blanks are then carried rapidly to the cutters and slowly through the cut, after which the table reverses and returns quickly to the starting point. During this reverse travel, the work blanks are indexed ready for the next cut. The cycle is completely automatic, and is continued until the gear blanks have been cut around their entire circumference. The table is brought to rest at the end of the out stroke, the work then being changed and the cycle repeated. One fixture is reloaded while the other is operating.

THOMSON PORTABLE SPOT-WELDER

A portable spot-welder, mounted on casters or small wheels so that it can be conveniently moved about a shop, or provided with four ears for suspension from overhead, is a recent development of the Thomson Electric Welding Co., Lynn, Mass. The unit consists of a 25-kilowatt or 35-kilovolt ampere transformer, on which are mounted a magnetic wall switch and a five-point regulator switch. The latter is connected to the tapped primary coil of the transformer for varying the welding voltage and current to suit different thicknesses of material.

To the cast water-cooled terminals of the secondary are attached large flexible cables which terminate in a pair of hand-operated pliers. These pliers are so designed that various shapes of welding electrodes can be quickly attached or removed. Pressure is placed on the welding points through the hand-lever which operates a rack and pinion. The pliers may be provided with throats of various



Thomson Spot-welder Designed for Portable Use

depths to accommodate different jobs. They are water-cooled. A push-button switch on the plier lever is connected to the operating coil of the magnetic wall switch.

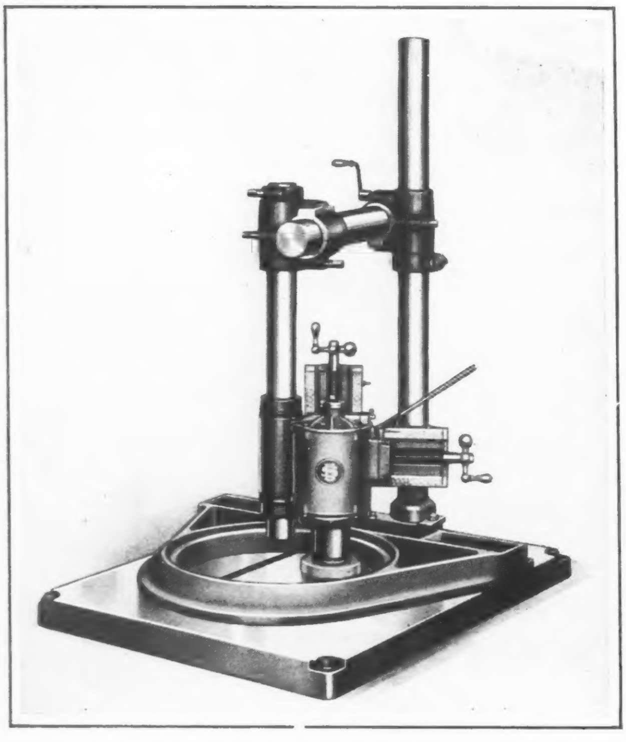
This unit is particularly suitable for welding light sheet-metal parts which, because of their shape or over-all dimensions cannot be conveniently brought to the conventional type of permanently located spot-welder. It is especially useful in welding operations on window frames, door frames, automobile body parts, and the like.

U. S. VERTICAL-SPINDLE GRINDER ON STAND

An electrically driven grinder especially designed for surfacing die-blocks and flat work of all kinds or for grinding manholes, etc., as illustrated, has been added to the products of the United States Electrical Tool Co., 2477 W. 6th St., Cincinnati, Ohio. This equipment is driven by a two-horsepower motor provided with ball bearings. The lower bearing is of the combined radial and thrust type.

The base of this equipment is machined, and has a top surface of 36 by 48 inches, provided with T-slots that facilitate the clamping of work. These slots start at the rear and extend about three-quarters of the way across the base.

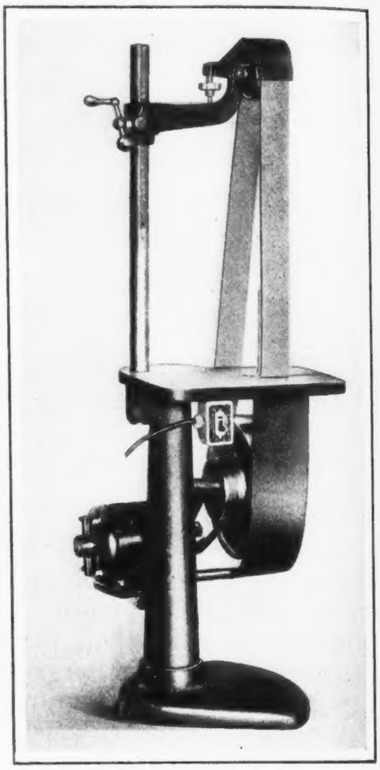
The upright column is a piece of 3 1/2-inch steel tubing and is 48 inches high. It has a double collar of the "pinch-bind" type, and is equipped with a stop-collar. The cross-arm is also made from 3 1/2-inch steel tubing and is 36 inches long. It is furnished with a fixed collar not of the "pinch-bind" type. The arm on which the grinder itself is mounted is a bar of 3-inch solid cold-rolled steel. The grinder-mounting collar is supplied at the top and bottom with ball bearings. The mounting may be adjusted 6 inches vertically and 8 inches horizontally. A 6-inch cup-wheel is furnished.



Motor-driven Vertical-spindle Grinder Arranged on Stand

SYRACUSE BELT SANDER FOR IRREGULAR-SHAPED PARTS

Parts of irregular shape, made from metal, wood, or other materials, can be readily polished or sanded on a type B-6 irregular belt sander recently developed by the Porter-Cable Machine Co., Syracuse, N. Y. This machine will take belts of any width from 1/2 to 3 inches, to meet the requirements of the work, and of any length from 95 to 125 inches. The belt passes over a pad directly above the table, against which the operator works in a manner somewhat similar to that followed in using a band saw. As the belt runs vertically, the work can be easily seen.



Syracuse Belt Sander for Irregular-shaped Work

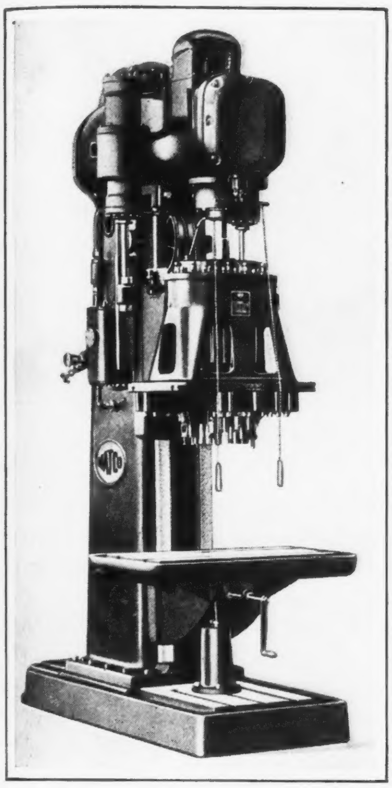
Pads can be furnished in any material, thickness, and degree of pliability. Some work requires solid wood or metal pads, whereas other operations are more efficient if a pad of soft texture is used. The machine is portable, and can be operated from a lamp socket or power line. It has a net weight of 265 pounds.

"NATCO" HYDRAULIC-FEED MULTIPLE-SPINDLE DRILLING MACHINE

A medium-sized "Natco" multiple-spindle drilling machine of the adjustable spindle type, equipped with a hydraulic feed, is being placed on the market by the National Automatic Tool Co., Richmond, Ind. Three types of heads have been designed for this model D13H machine. There are 12- by 18-inch and 16- by 24-inch rectangular heads, arranged for either twenty-two or twenty-four spindles, and an 18-inch round head arranged for twelve spindles. All heads are provided with the patented independent speed change to each spindle, or the spindles can be run at a single speed if desired. There is a neutral position for spindles not in use.

The hydraulic feed constitutes the principal feature of this machine. Two 5-inch low-pressure oil cylinders mounted in heavy brackets at the top of the column have a maximum combined pressure of 8000 pounds, which is applied directly to the head flange itself. The control of the feed is simple and positive through two handles which are within easy reach at all times. To start each cycle of the head, it is only necessary to pull one of these handles. This gives a rapid downward movement of the head,

a downward feed, and a rapid return, at the end of which the head is stopped. All these movements are controlled automatically by adjustable trip-dogs on the left-hand head clamp. The second handle can be pulled in an emergency to stop the head and automatically return it to the starting position.



"Natco" Multiple-spindle Drilling Machine with Hydraulic Feed

The pump is located on the top of the column, and the oil reservoir is also located in the column. The pump is gear-driven from the maindriveshaft, and is equipped with a by-pass which allows excess oil to return to the reservoir when a given pressure has been reached. This arrangement protects the drills in case unusually hard spots are encountered in the work, as the pressure cannot be built up beyond the correct feeding pressure.

Improved and patented adjustable spindle bearings and arms having a total vertical adjustment of 2 inches are furnished. The machine is equipped with a direct motor drive, power being delivered through a horizontal shaft mounted in ball bearings to a train of change-gears, and thence through a set of spiral bevel gears direct to the head. Some of the important specifications of the machine are as follows: Distance from center of head to face of column, 15 1/2 inches; dimensions of table working surface, 40 by 23 inches; and maximum travel of head, 19 inches.

"RIGIDMIL" WITH HYDRAULIC OR MECHANICAL FEED

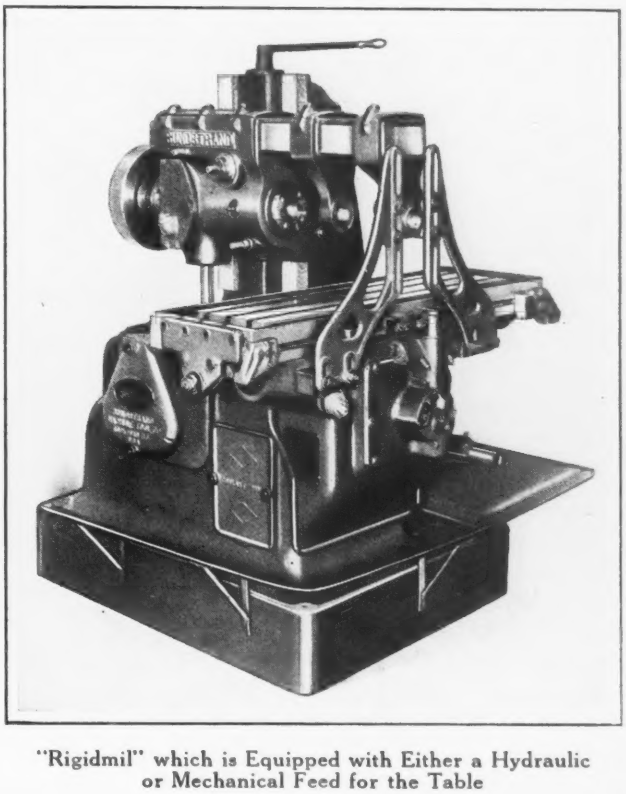
A No. 30 "Rigidmil," equipped with either a hydraulic or a mechanical feed, has recently been produced by the Sundstrand Machine Tool Co., Rockford, Ill. This machine is slightly smaller than the standard No. 3. The advantages of the hydraulic equipment are that it furnishes an unlimited variety of feeds within a specified range, a rapid approach, an automatic relief if the cutter becomes overloaded, a dwell at the completion of the cut, and an automatic quick return to the starting position. Increased production is also claimed.

The hydraulic unit comprises an Oilgear pump which is mounted in the base. Controls and adjustments are conveniently located so that the feed best suited to the work can be instantly obtained. If abnormal conditions cause an overload on the cutter, the hydraulic feed automatically retards, and when conditions are normal again, it accelerates to the set rate. Thus it will be seen that the hydraulic unit enables the operator to select the maximum feed without danger of damaging the cutters, machine, or fixture. It is also claimed that this feed prolongs the life of cutters in heavy-duty service.

Manual control of the feed is provided through the lever on the front of the saddle, which may be set in any of five positions indicated by letters on the index-plate mounted above the lever bearing. Reading from left to right, these letters indicate, respectively, rapid traverse to left; feed to left; neutral; feed to right; and rapid traverse to right. Movement of the lever to the right or left results in a table feed or traverse, as selected, in the same direction as the lever movement. Any desired rate of feed between 0 and 50 inches per minute may be obtained by setting a lever located on the right-hand side of the column in the proper position. The rapid traverse is set at 103 inches per minute.

The table may be controlled automatically by two stop-blocks with nine dogs located between them, all of which are adjustable. These blocks cause the table feed to be disengaged within plus or minus 0.002 inch of a selected point. The dogs may be used in various combinations to obtain any desired cycle of feeds and rapid traverse movements. Work may be traversed rapidly to the cutters, the feed engaged, and the table returned to the starting point on the completion of the cut, all automatically. The dogs may also be set to give a rapid traverse and feed alternately, as long as desired.

The mechanical feed can be readily substituted for the hydraulic feed, or vice versa, at any time. The mechanical feed unit comprises a gear-box with pick-off gears and a longer drive shaft than is used with the hydraulic unit. Three pairs of



"Rigidmil" which is Equipped with Either a Hydraulic or Mechanical Feed for the Table

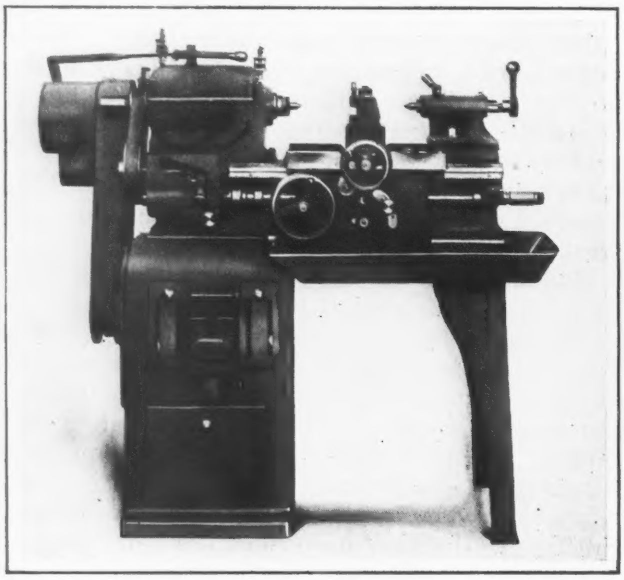


Fig. 1. Sebastian Manufacturing Lathe Available with One or Two Spindle Speeds

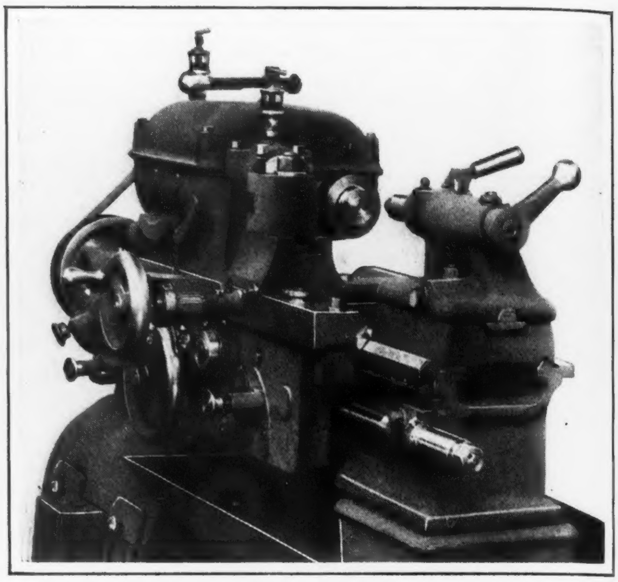


Fig. 2. View Showing the Quick-acting Tailstock, Tool-block, Carriage, etc.

pick-off gears are ordinarily supplied to give six feeds from 1.49 to 22 inches per minute.

In other details of construction, this machine follows previous "Rigidmils." The working surface of the standard table measures 14 1/4 by 50 inches, but a table measuring 14 1/2 by 70 inches can be supplied. The height of the table from the floor is 32 inches. A five-horsepower motor running at 1200 revolutions per minute is recommended for driving the machine. The hydraulic feed unit is self-lubricating, and provision is made for thorough lubrication of all other working parts. Coolant is pumped to the cutter at the rate of six gallons per minute.

GENERAL ELECTRIC ELECTRODE HOLDER

The General Electric Co., Schenectady, N. Y., has recently brought out a clamp type of electrode holder as a supplement to its line of electric arc-welding equipment. This device has heavy jaws of a copper alloy which are notched to hold firmly any size of electrode wire from 1/16 to 1/4 inch in diameter, in any position. A molded compound handle protects the operator from heat and from contact with current-carrying parts. The holder is designed for use with currents up to 300 amperes.

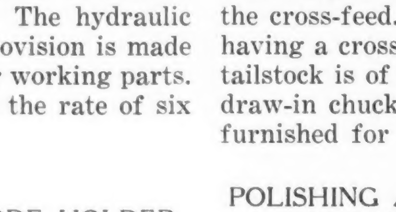
SEBASTIAN MANUFACTURING LATHE

An 11-inch manufacturing type of lathe that can be furnished for operation at one or twc speeds has recently been added to the line of "Gold Seal" lathes built by the Sebastian Lathe Co., 106 Culvert St., Cincinnati, Ohio. The regular spindle speed with a standard motor is 1200 revolutions per minute, but an additional speed of 600 revolutions per minute can be provided for. The headstock is equipped with a silent chain transmission that runs in oil, there being no meshing gears in the headstock.

Four feeds of 0.010, 0.021, 0.042, and 0.080 inch per spindle revolution are available through the feed gear-box. The lever on the apron is employed to engage longitudinal feeds. Diameter stops for which a patent has been applied are furnished for the cross-feed. The plain tool-block receives tools having a cross-section of 1/2 by 1 1/8 inches. The tailstock is of a quick-acting design. A lever-type draw-in chuck, rear tools, gang tools, etc., can be furnished for special production jobs.

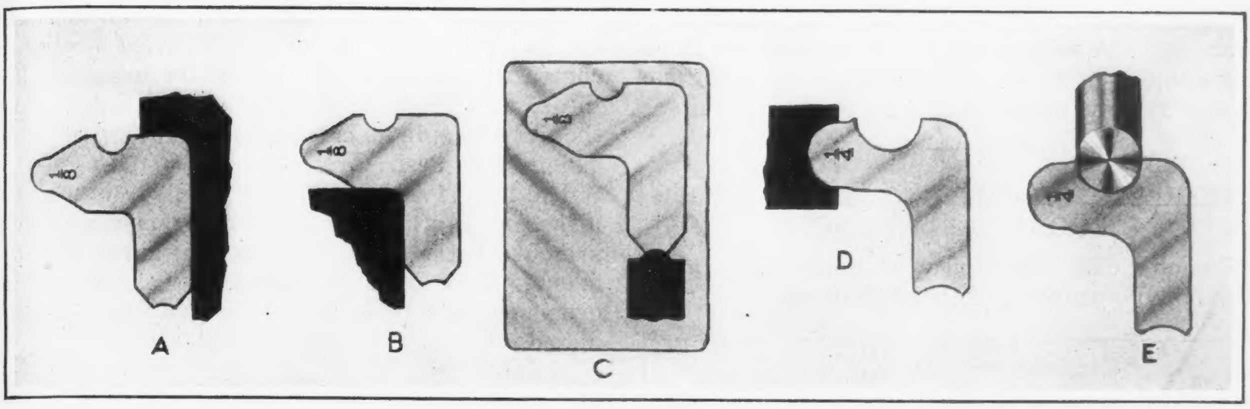
POLISHING ATTACHMENTS FOR SCHRANER CRANKSHAFT HONING MACHINE

Crankshaft honing machines built by A. P. Schraner & Co., Payne Ave. and E. 33rd St., Cleveland, Ohio, may now be provided with polishing attachments of a new design to suit manufacturers who prefer the use of polishing paper or cloth instead of abrasive stones for finishing crankshaft bearings. The machine itself, which has previously been illustrated and described in the technical press, is the same as respects design and operation.



Polishing Attachment for Crankshaft Honing Machines

The new polishing attachments are of the construction illustrated, and are mounted in place of the regular abrasive stone holders. Rolls of polishing paper or cloth are loaded on the spools of the attachment, which are arranged with an automatic motion that feeds the necessary amount of fresh paper with each loading of the machine. Clamping shoes bored to the diameter of the bearings on which they work back up the polishing paper or cloth. By



Various Applications of Radius Gages Manufactured by the Lufkin Rule Co.

feeding fresh paper or cloth in a predetermined amount between operations, uniform results are obtained and a saving in material is effected.

The difference in finish obtained by honing with stones or polishing with paper varies slightly, although almost any degree of finish can be secured by using different grades of paper or of stones.

LUFKIN IMPROVED RADIUS GAGES

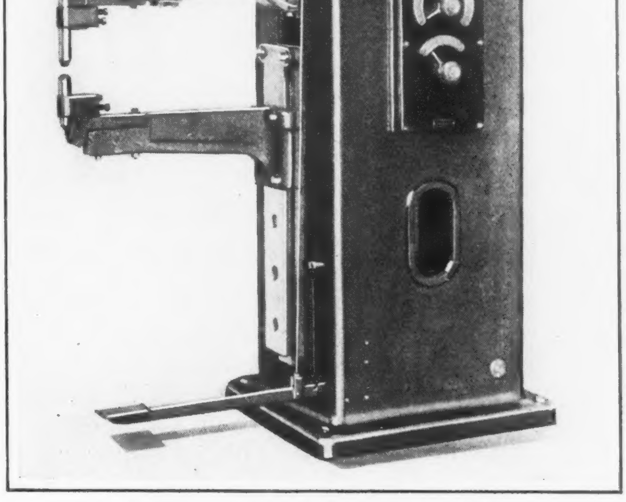
A set of sixteen individual radius gages for checking any radius from 1/32 to 17/64 inch, in increments of 1/64 inch, is being placed on the market by the Lufkin Rule Co., Saginaw, Mich. Both external and internal forms are provided on each gage.

The illustration shows a few of the many ways in which the gages can be used. At *A* is shown the manner in which a gage is employed for determining the radius of an inside corner or fillet for one-quarter of a circle or less. The straight sides of the gage are at an angle of 90 degrees in relation to each other and can therefore be used for checking the location of the fillet. View *B* shows how a gage is used to determine the radius of outside corners and to determine whether the sides of the work are 90 degrees from each other and tangent to the arc.

View *C* illustrates a piece of work being checked on glass. The portion of the gage being used may be employed for any convex surface having a rounded portion one-quarter of a circle or more when the work has projections that do not permit the use of a gage such as illustrated in views *B* or *E*. View *D* shows the manner of using a gage on a concave cutter in which the hollow portion is one-half a circle or less. The same end of the gage can also be used to check a radius, as shown at *A*, but it will not indicate the relation of a fillet to sides. As illustrated at *E*, a gage may be used to determine the size of one-half of a circumference.

POWER DRIVE ATTACHMENT FOR THOMSON SPOT-WELDERS

The standard series of medium- and heavy-duty spot-welders manufactured by the Thomson Electric Welding Co., Lynn, Mass., may now be equipped, as illustrated, with a power drive attachment. This unit consists of a one-horsepower motor connected through a three-speed "Texrope" drive to a gear-reduction unit and a shaft carrying a cam that actuates the upper electrode or welding die. The cam is of an adjustable split type for controlling the current dwell and synchronizing with the welding cycle. The actual pressure on the welding electrodes is adjustable. The power drive unit may be attached to any standard welder of this type having a throat depth of from 1 to 4 feet and a transformer capacity of from 25 to 75 kilovolt amperes.



Thomson Power-driven Spot-welder

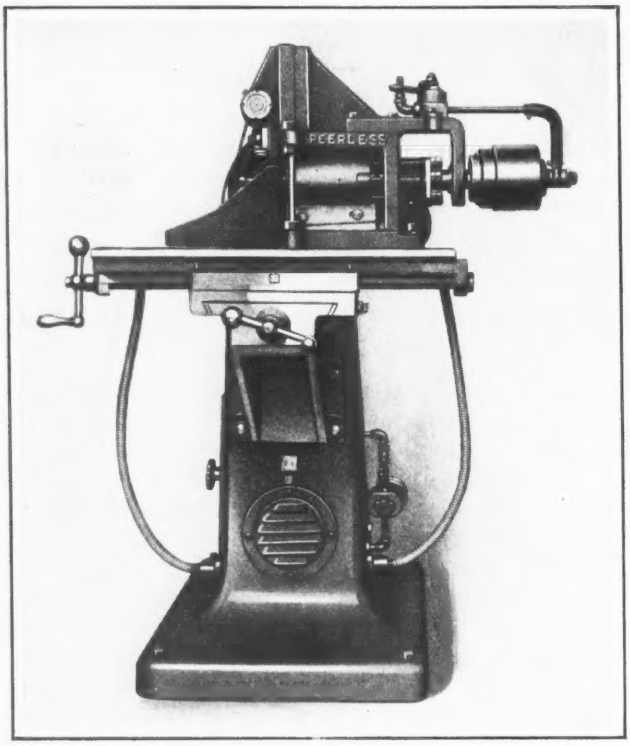
The ways or slides for the upper head of the machine shown are of the rectangular type and are adjustable for wear. The lower horn is adjustable vertically through a distance of 12 or 24 inches. A special brace supplied for the lower horn (not shown in the illustration) is intended for use in welding work that does not surround this horn. This brace is particularly advantageous in welding the heavier gages of material or flat stampings by the projection method, where large flat-faced dies are used and it is essential that these dies remain parallel at all times.

A tooth clutch controlled through a foot-lever is used. The welder may be operated either as a single-stroke ma-

chine or continuously by keeping the clutch lever depressed. A wide range of welding speeds is obtainable for different classes of work by using motors of various speeds and gear-reduction units.

"PEERLESS" CHAMFERING MACHINE WITH "LOGAN" AIR CYLINDER

Pneumatically operated work-holding equipment may now be provided on the "Peerless" gear-tooth



"Peerless" Gear-tooth Chamfering Machine with Air-operated Work-holding Equipment

chamfering machine built by the City Machine & Tool Works, 1517-1531 East 3rd St., Dayton, Ohio, which was described in November, 1928, MACHINERY, page 232. The accompanying illustration shows the machine provided with the pneumatic equipment. This equipment consists of a Logan air cylinder in connection with which a C-washer or an expanding arbor is employed to hold the gears securely for the chamfering operation. Increased production is the principal advantage cited for the air equipment, it being stated that the output is increased from 20 to 30 per cent.

NEW FEATURES OF STARRETT MICROMETERS

All micrometers manufactured by the L. S. Starrett Co., Athol, Mass., with the exception of the Nos. 238 and 239, may now be obtained with the thimble graduated in divisions of 0.0005 inch. This feature is intended to facilitate accuracy in working to close limits. Another feature, which is especially useful to instructors and apprentices and to some mechanics, is the consecutive numbering of intermediate graduation lines on the thimble denoting thousandths of an inch. This method of marking is also provided on all micrometers except Nos. 238 and 239.

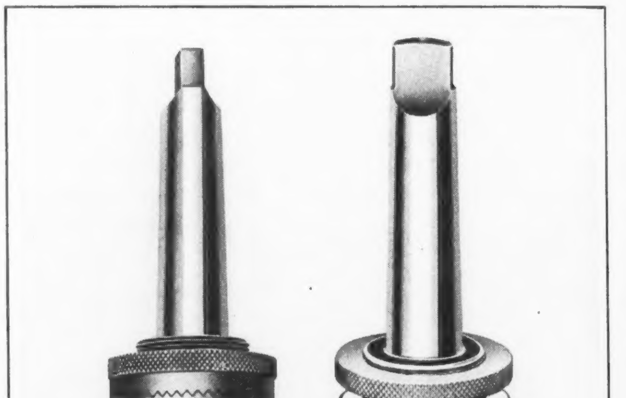
Micrometer No. 436 may now be obtained with the lock-nut feature in which a knurled locking nut contracts a split bushing around the spindle to keep the spindle central and true. By a slight turn of the nut, the spindle is locked firmly to make a solid gage, when desired.

The No. 440 micrometer depth gage is now furnished with a ratchet stop which insures uniform pressure at the point of contact in taking measurements. More accurate readings are assured by this provision, as the chance of unequal "feel" is eliminated.

ECLIPSE QUICK-ADJUSTABLE STOP-COLLAR HOLDERS

Stop-collar holders of a new design that may be quickly adjusted by hand are being introduced to the trade by the Eclipse Interchangeable Counterbore Co., 7410 St. Aubin Ave., Detroit, Mich. This holder is intended for use in counterboring, spot-facing, countersinking, or core-drilling to specified lengths or depths. The adjustable collar stops against the top of a fixture bushing or against the work itself, and thus regulates the depth of cut or the length of travel.

Instant adjustment of the collar up or down is accomplished by merely backing off the upper lock-nut, lifting the drive washer, turning the stop-collar to the desired position, and then lowering the



Eclipse Stop-collar Holder Quickly Adjusted by Hand

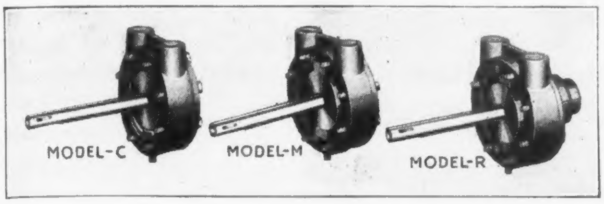
drive collar and turning down the lock-nut, all of which is done by hand. A slight pressure of the lock-nut on the drive washer, when engaged with the stop-collar, suffices to lock all parts solidly in place on the holder.

The accompanying illustration shows a holder designed for use in a drilling machine. By providing a straight shank, the same holder may be used

for turret lathe tools. These holders are manufactured in all standard sizes for use with Eclipse standard and special counterbores, core drills, etc. A patent on the construction of the holders has been applied for.

TUTHILL "STRIPPED" PUMPS FOR MACHINE TOOLS

Lubrication, coolant, and hydraulic service pumps, which can be built directly into the construction of machine tools instead of being mounted on a projecting pad or pedestal, have recently been



Three Tuthill Pump Units which can be Built Directly into Machines

placed on the market by the Tuthill Pump Co., 131 W. 63rd St., Chicago, Ill. These new pumps are modified forms of the models M, C, and R manufactured by this concern. As may be seen in the illustration, the modified forms comprise all important parts of the pumping unit. They can be applied to almost any mechanism with the simplest form of an adapter.

* * *

LAPPING GEARS, WORMS AND WORM-WHEELS

By H. J. WILLS, Engineer, The Carborundum Co., Niagara Falls, N. Y.

The lapping of gears is a necessary and very important operation wherever quiet and smooth running parts are essential. Both soft and hardened gears require lapping to remove cutter marks and imperfections in tooth profile, and to correct distortion caused by heat-treatment. Many gears that were formerly scrapped due to minor surface imperfections are now successfully reclaimed by the lapping process.

Soft metal gears are usually mounted on an arbor which is placed between centers on a special lapping machine having adjustments for varying the mesh of the gears. Hardened steel gears, owing to their comparatively small diameters, are generally mounted in a lathe and lapped on centers only. If the lapping machine equipment has adjustment for varying the mesh of the gears, it is strongly recommended that the gears be lapped in three positions —on close centers, on wide centers, and on regular meshing centers.

After the gear has been mounted and is in motion, an abrasive, such as, Carborundum Brand finishing compound should be applied with a paint brush in sufficient quantity to wet the entire surface of the gear teeth; on very large gears, the surface of the teeth should be moistened with kerosene or machine oil before applying the compound. The best results are obtained if the gears are lapped under a light load and at such speeds as will not cause the compound to be thrown off. A speed just below the point where the compound would be thrown from the gears is the most desirable. Owing to the fast cutting characteristics of the compound, a frequent examination of the lapping action is necessary on the first gears that are lapped, in order to determine the actual time required to obtain the desired results.

The successful operation of any compound depends a great deal on selecting the proper grading for each specific class of work. For the lapping of soft metal gears, the writer recommends Carborundum Brand finishing compound in WL5-4 coarse, WO5-4 medium, or WR5-4 fine grade, depending on the size and condition of the gears. If an exceptionally high finish is required, the grading HX2-40 should be used. For the lapping of hardened steel gears, the RL4-4 grading is recommended for a fast cut on rough gears; but where the gears are small and a smooth finish is essential, a special and finer grade, RT4-4, is better. Hardened steel gears may also be lapped in with soft metal companion gears. For lapping this type of work, the grade of compound recommended for soft gears should be applied.

The lapping of worms and worm-wheels is one of the simplest of all gear lapping processes. When lapping worms only, the worm is mounted between centers on a driven spindle. A cast-iron, brass, or micarta lap, made to the same form as the meshing worm-wheel is mounted on a two-way carriage, and after pressing the lap firmly into the worm threads, the machine is started and the compound applied with a brush while the lap traverses the worm once in each direction the full length of the threads. Worms up to about 2 inches in diameter are lapped by this method in from five to ten seconds. The most suitable grade of Carborundum Brand finishing compound for lapping the larger diameters is RT4-4, and for the smaller diameters, the grading RU4-9 is the most efficient. Where tool marks are deep, the grading RS4-9, which is a faster cutting compound, is the most satisfactory for both large and small worms.

When lapping worms and worm-wheels simultaneously, the same machine as described for lapping worms only is used, except that the worm-wheel takes the place of the manufactured lap. The grading WR5-4 is usually the most suitable for this operation, unless a coarser grading is required, when the WO5-4 grading is preferable.

The foregoing methods apply to lapping on a production basis with adequate machine equipment. In plants where production is small and more or less intermittent, or where lapping machine equipment is not available, the gears and worms can be assembled and satisfactorily lapped in their housings. If this method is employed, the compound should be applied sparingly, so that it will not flow or drip into the bearings or housings.

While the abrasive content in the compound will not charge or impregnate the metal, the parts should be thoroughly cleaned after lapping, in order to remove any loose particles of abrasive. This cleansing is best accomplished by brushing or spraying the gears with either kerosene or hot water.

DIMENSIONING DRAWINGS

By ERIK BONANDER

The system of dimensioning drawings, proposed on page 446 of February MACHINERY, has some objectionable features. It is suggested that the dimension lines be made continuous, as shown in Figs. 1 and 2 of the original article. This has long been the practice in countries using the metric system with which it is not likely to cause mistakes. With our system of measurements, this is not the case, and mistakes are likely to occur; for example, when a 4-inch dimension is given below a 3-inch dimension, the latter may be mistaken for 3/4 inch. For this reason, it seems that it is better practice to separate the dimension lines in the usual way.

It is also proposed that, whenever possible, no dimensions be placed on the part shown in the drawing. Such a practice often causes confusion; mistakes are easily made by a man who has to follow one line among several others for some distance, in order to find the dimension he needs. These extended dimension lines may also give the workman the wrong impression regarding the shape of the part. For example, the dimension line for the depth of the counterbore shown in Fig. 1 of the original article, gives the impression that the flange is beveled downward at the end. In many drafting-rooms, the drawings are not inked in, the blueprints being made from the original pencil drawings on which dimension lines are likely to be mistaken for lines belonging to the part. Therefore, the best practice would be to locate the dimensions as close as possible to the points between which the measuring is to be done.

Finally, it is proposed that all dimensions be given from the reference lines by omitting arrow-heads, as shown in Fig. 1 of the original article. This is not good practice, since it often happens that the distance *between* two points is more important than the distances from these points to their respective reference lines. The most important dimensions should always be given, and the less important ones omitted. Let us suppose that two of the holes shown in the cover plate, Fig. 1, of the original article, are to receive shafts for gears that are to be properly meshed. In this case, it is more important to give the center distance between the shaft holes than to give their distances from the edges of the plate.

To overcome this difficulty, it is proposed that a mixture of the two systems of dimensioning be used, as shown in Fig. 2 of the original article. It is easy to conjecture what would happen in the case of the proposed mixed system of dimensioning, if the draftsman omits an arrow-head or if he places an arrow-head where there should be none. The checker does not always catch errors of this kind, and should not be bothered with too many details.

The dimensions between the center lines shown in Fig. 2 of the previous article are given in addition to the others, because the workmen who turn the rolls insist on having them. Apparently, the machinists do not need the other dimensions, and there is no reason for giving them. If they are given, the drawing obviously has two sets of dimensions for the same points. If, after the drawing has been in use for some time, it becomes necessary to change one of the dimensions, care must be taken to see that both sets of dimensions are changed; otherwise, endless trouble will result. Referring to Fig. 1 in the previous article, it will be noted that the length of the cover plate is given in five separate places. Only one such dimension should be given, thus eliminating the chance for errors.

* * *

THE COST OF ELECTRIC HEAT IN FURNACES

In a paper by A. N. Otis and W. L. Warner of the General Electric Co., Schenectady, N. Y., read before the Western Metal Congress at Los Angeles, Calif., the subject of the cost of electric heat for furnaces was quite completely discussed. The authors stated that the reliability of electric furnaces in operation and their low cost of maintenance are accepted without question, but the cost of heating by the electric current, as compared with combustible fuels, is still a subject of discussion.

"No general solution to this question can be given," said the authors, "as the relative cost of heating depends upon the type of furnace, the temperature required, the operating cycle, the rates for electricity prevailing in the locality, and other factors having an influence in a specific case. The cost of heating, however, is only one of the items entering into the cost of operating the furnace, and in any case is a very small item in the cost of manufacturing the product—usually about 1 per cent—so that any improvement in quality or other advantages to be gained by using a higher cost fuel might more than offset the difference in fuel cost.

"The furnace should therefore be viewed from the standpoint of its effect on the cost, the quality, and the value of the product, and not merely from the point of view of the efficient utilization of fuel. While it is true that electricity is the most expensive fuel on a B. T. U. basis, it is also true that in many cases furnaces can be maintained at a given temperature and work done at a lower cost with electric heat than with combustible fuels for heat alone. As an example, take the ordinary box type furnaces, hundreds of which are in daily operation. Many of these are used in tool-rooms or for other purposes that require them to stand idle a large part of the time, but they must be maintained at temperature and ready for use at all times. Comparatively little of the heat is actually used. The losses from electric furnaces are very small, due to efficient heat insulation, while the losses from fuel furnaces are relatively large, due to the flue losses.

"Carburizing furnaces are sometimes required to hold the charge constant for twenty or thirty hours or more, after reaching the required temperature, and the small losses of electric furnaces make them very economical for this service. An electric furnace 3 feet wide by 6 feet long will require 51,000 B. T. U. per hour to maintain in it a temperature of 1600 degrees F.

"Electric furnaces are particularly well adapted for applying vitreous enamel coatings, in the manufacture of kitchenware, stoves, refrigerators, etc. The advantages lie in the clean atmosphere, free from dirt, soot, or gases, which might spot or stain the ware, and in the possibility of properly distributing the heating units and controlling the temperature so that all the ware is uniformly burned.

CHUCKING WORK FOR PARALLEL FACING

By WILLIAM S. ROWELL

The description of an appliance designed to facilitate chucking work for parallel facing, which appeared in November MACHINERY, page 199, prompts the writer to describe a method that he has employed successfully for some time, but that is not in common use.

The piece is first chucked with the finished surface facing the chuck. The work should be approximately true with respect to the finished surface, the accuracy depending upon the amount of stock to be removed. A trial cut is then taken, removing just sufficient stock to permit the thickness of the part to be accurately measured with a micrometer at four points. The high points are thus located and the difference in thickness determined.

Corrections in the setting of the piece are then made to compensate for the variations in thickness by forcing the thin portions back into the chuck. This is done by bumping the work with a piece of babbitt or a soft-faced hammer. Accuracy in resetting the work by bumping is secured in two ways, either by using an indicator or a feeler gage between the tool and the work.

* * *

COUNTERBORING BOTH SIDES OF A LEVER SIMULTANEOUSLY

By J. E. FENNO

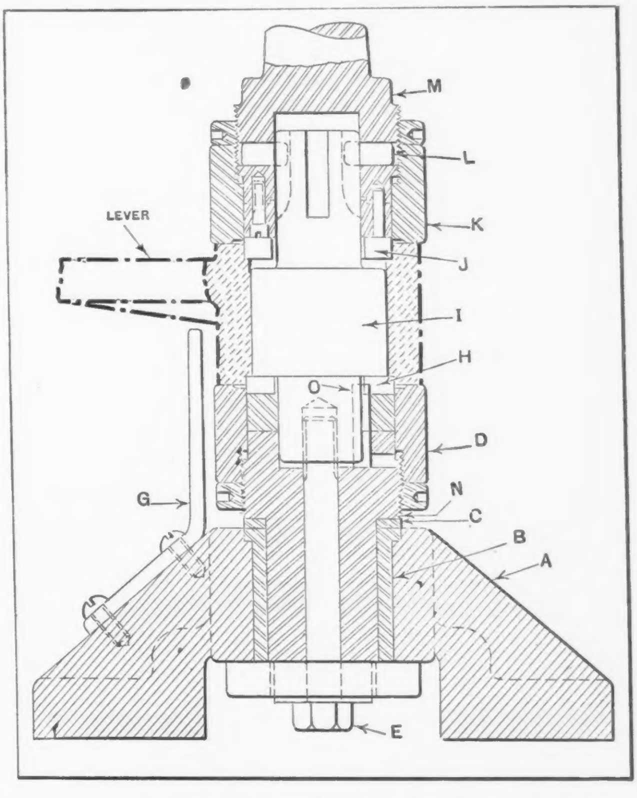
The fixture shown in the accompanying illustration was designed for use in counterboring both sides of a lever simultaneously. The lever, which is shown by heavy dot-and-dash lines, is a component part of a bread-mixing machine. The part is first straddle-milled in a fixture of the gang type, after which it is bored and reamed in a jig. Previous to the development of the fixture shown, the counterboring was also done in the drill jig. However, the latter method consumed considerable time, as it was necessary to change tools and slip bushings and turn the jig over for the counterboring operation. Through the use of the new fixture, it has been possible to increase production on the counterboring operation approximately 25 per cent.

Referring to the construction of the fixture, the hardened steel bushing *B*, which forms a bearing for the rotating member *M*, is driven into the base *A*. The downward thrust of the tool is taken by the hardened steel washer *C* on the shoulder of bushing *B*. Provision is made for lubricating these bearing members. The pilot *I* is a sliding fit in both the counterbore *H* and the member *N*. These three members of the fixture are all held rigidly in place by means of a bolt *E* and the key indicated at *O*.

The stop *D* is adjustable, and is held rigidly in place by a check-nut. In the top end of pilot *I*, which is a sliding fit in counterbore *J* and member *M*, are cut four splines which engage the two driving pins *L*. These pins are a press fit in member *M*. The counterbore *J* is screwed on the member *M* and fastened with dowels. A stop *K*, similar to the one shown at *D*, is used for this counterbore.

The taper shank of member *M* is machined to fit the spindle of the upright drilling machine on which the fixture is employed. When the fixture is in use, the top counterbore *J* revolves continuously, and is raised to permit a piece of work to be placed over the pilot *I* which remains stationary when the spindle is in the upper position. The spindle is next lowered until the pins *L* engage two of the slots in the pilot *I*, causing the latter member, together with the counterbore *H*, to revolve. A further downward movement of the machine spindle causes the two counterbores to be fed into the work to the required depth, which is governed by the position of the two stops *D* and *K*. Both counterbores rotate in the same direction, the teeth of one being cut right-hand, and those of the other, left-hand.

A post, not shown, is bolted to the table of the machine and serves as a stop for the work, thus



Fixture Used on Drilling Machine for Counterboring Opposite Sides of Lever Simultaneously

preventing it from swinging around while the cutters are in operation. The arm *G*, fastened to the base *A*, prevents the operator from placing the work on the fixture with the short side of the hub down.

* * *

PRESSED METAL INSTITUTE MEETINGS

The Pressed Metal Institute, 232 Delaware Ave., Buffalo, N. Y., has held two meetings during June, one on June 7 at Bridgeport, Conn., and one on June 14 at Youngstown, Ohio. On account of the present interest in predetermining the deep drawing qualities of steel, this subject had a prominent place on the programs of both meetings. Representatives of leading steel mills presented their experiences, and others who have worked on this problem added to the discussion by giving their views on the subject.

THE FOREMAN AS DEPARTMENT MANAGER

In an address before the sixth annual convention of the National Association of Foremen at Indianapolis, Ind., Alfred Kauffmann, president of the Link-Belt Co., emphasized the responsibility of the foreman in an industrial plant as the manager of his department. In addressing the foremen's convention, Mr. Kauffmann said in part:

"Are you not the business managers of your department? Would you or could you do differently than you are now doing, if you could put your department in a separate building, on a different lot, and put a sign with your name over the door?

"You were not picked because you had a pull. As business manager of your department you were chosen because you had certain definite qualifications. You were a good workman, a master craftsman. You understood the 'know-how' of the business, and you know how to get along with people.

"You need new men in your shop. Either you—the foreman,—or the employment manager must hire them. Both of you are poor salesmen if you can't sell the job to the prospect, because the man who asks for employment is a buyer of a job, and if you need him, it is your business to sell him one.

"You should try to learn more about manufacturing economies and accounting—have a clear insight into such overhead items as equipment depreciation, tool cost, scrap charges, supply costs, supervision and inspection charges, and the like in their relation to direct charges and total costs.

"But more important than all is a working knowledge of *human beings*. Bear this in mind: Every man pays for the amount of bossing he requires, and likewise every man's wages increase in proportion to his ability to act as a boss or foreman of himself and others. The lower the wage rate, the greater the amount of watching and direction constantly required. The highest wages are paid to the man through whose ability the largest number of other men may be profitably employed."

* * *

OIL AND GAS POWER MEETING

The Oil and Gas Power Division of the American Society of Mechanical Engineers held its annual meeting June 24 to 27 at the Pennsylvania State College. The first day was given over to high-speed Diesel-engine design, with Charles L. Lawrance, president of the Wright Aeronautical Corporation, and George W. Lewis, director of research of the National Advisory Committee on Aeronautics, as the presiding officers for the two sessions. The possibilities of high-speed oil engines in the aeronautic field has aroused great interest, and these sessions discussed the detailed problems, the solution of which will eventually give a reliable aeronautic Diesel engine. The other sessions dealt with Diesel power-plant refinements, cost of Diesel power and marine operation, and fuel-oil specifications and oil-engine ratings.

* * *

It is said that the world's greatest iron deposits, containing some 12,000,000,000 tons of the highest grade ore lying close to the surface, are located in the state of Minas Geraes, Brazil.

HOW MACHINERY INCREASES PRODUCTION

The effect of machinery on production is remarkably well illustrated by the increase in the use of cotton with the invention of the cotton gin. As pointed out in an article by W. H. Rastall, chief of the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., in 1791 the total production of cotton in this country was about 4000 bales. The only way to remove the seeds from the lint was by hand, a tedious occupation which occupied most of the time of the labor in the cotton states. In 1795 the cotton gin was a demonstrated success and was immediately accepted and applied. In 1800 the production of cotton had expanded to 73,000 bales; in 1810, to 178,000 bales; in 1820, to 335,000 bales; in 1850 to 2,136,000 bales; and in 1926 to nearly 18,000,000 bales. This production would have been utterly impossible without the cotton gin. The rapid development of cotton growing brought prosperity and wealth to the South and made the textile industry of New England possible.

It is further pointed out that in a razor blade factory an operator is now, with the aid of the latest machinery, able to produce 32,000 razor blades in the same time that he produced 500 in 1913. The production per man since 1914 in the automobile industry has been increased 172 per cent; in the iron and steel industry, 59 per cent; in the cement industry, 61 per cent, all of which has been made possible through improved machinery. The significance of this increased production is that through it the standard of living of the entire population has advanced. The industrial revolution created by machinery has changed the entire trend of human life.

* * *

GEAR MANUFACTURERS ELECT OFFICERS

At a meeting of the executive committee of the American Gear Manufacturers' Association all the officers of the past year were re-elected as follows: President, A. F. Cooke, vice-president of Gears & Forgings, Inc., Pittsburgh Branch; first vice-president, B. F. Waterman, engineer, Brown & Sharpe Mfg. Co., Providence, R. I.; second vice-president, E. W. Miller, chief engineer, Fellows Gear Shaper Co., Springfield, Vt.; treasurer, Warren G. Jones, president, W. A. Jones Foundry & Machine Co., Chicago, Ill. T. W. Owen, with headquarters at 3608 Euclid Ave., Cleveland, Ohio, remains secretary.

* * *

TRADE PRACTICES IN THE FOUNDRY INDUSTRY

The Gray Iron Institute, Inc., Terminal Tower Building, Cleveland, Ohio, has just published a folder containing the standard sales terms and trade customs adopted by the Gray Iron Institute. The folder contains the terms and conditions upon which all quotations are made, together with the trade customs applying to quotations, orders, and pattern and core-box equipment. A definite statement of the trade customs and sales terms adopted by the gray iron foundry industry should prove of great value to the entire foundry field.

PERSONALS

JOSEPH MONAHAN, Grand Rapids, Mich., agent for machine tools and equipment, has moved his office to 321 Lake Michigan Drive (Shawmut Boulevard).

C. A. ANDERSON has been appointed sales manager of the Ford Chain Block Co., Second and Diamond Sts., Philadelphia, Pa., manufacturer of hoists and trolleys.

RICHARD A. HEALD, who has been closely connected with the sales division of the Heald Machine Co., Worcester, Mass., is now chief engineer of that company. WALDO GUILD, previously chief engineer, is now consulting engineer.

W. W. BRICKA has been appointed general manager of the Goodell-Pratt Co., Greenfield, Mass., manufacturer of small tools. Mr. Bricka has had wide experience in both manufacturing and merchandising.

W. W. Bricka, Newly Appointed General Manager of Goodell-Pratt Co.

Edward L. Ryerson, Jr., New President of Joseph T. Ryerson & Son, Inc.

EDWARD L. RYERSON, JR., has been elected president of Joseph T. Ryerson & Son, Inc., Chicago, Ill., succeeding JOSEPH T. RYERSON. Joseph T. Ryerson will remain a member of the board and will continue to hold the office of treasurer. Edward L. Ryerson, Jr., has had twenty years' experience in the operating and marketing divisions of the business. Joining the Ryerson Co. in 1909, he began in the plants operating department and held the position of works manager for several years prior to the war. Early in the war he entered the service with the Aircraft Production Board in Washington, and was later made captain in the Air Service Division of the Signal Corps. He was elected vice-president of the company in 1922, and vice-president and general manager in 1928. Mr. Ryerson is a member of the board of trustees of the University of Chicago, and is active in many civic enterprises.

WILLIAM M. PRATT, president of the Goodell-Pratt Co., Greenfield, Mass., will sail July 10, on an extended trip to Central Europe. Mr. Pratt will visit the company's branch at London and their various representatives on the Continent.

GEORGE F. MOSHER was elected assistant treasurer of the General Electric Co., Schenectady, N. Y., at a recent meeting of the board of directors. Mr. Mosher graduated from Union College in 1918, and entered the accounting department of the General Electric Co., in 1919.

F. O. WEBER has been appointed sales manager for the Pittsburgh district of the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill., manufacturer of welding equipment and supplies. Mr. Weber's headquarters will be at 229 Boulevard des Allies, Pittsburgh.

WILLIAM S. JONES, formerly vice-president of the Carpenter Steel Co., has been made vice-president in charge of sales of the Universal Steel Co., Bridgeville, Pa., and the Cyclops Steel Co., Titusville, Pa. Mr. Jones will make his headquarters at 10 E. 40th St., New York City.

JOHN F. PETERS, consulting engineer of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has been awarded the Longstreth medal of the Franklin Institute for his invention the "klydonograph," by means of which the effect of lightning as it strikes an electric transmission line is recorded.

W. W. PHILLIPS has been appointed district sales manager for the metropolitan, New York, and eastern states district of the Columbia Tool Steel Co., Chicago Heights, Ill. Branch office and warehouse space has been taken at 87 Poinier St., Newark, N. J., where a large stock of high-speed, alloy, and carbon tool steel will be carried.

J. S. TRITLE, in charge of manufacturing operations of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was made a vice-president of the company at a recent meeting of the board of directors. Mr. Tritle has been an outstanding figure in the electrical industry for many years. He will make his headquarters at the main plant of the company in East Pittsburgh.

B. W. BROWN has been made district sales representative, with headquarters in Milwaukee, Wis., of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of "Stable-Arc" welders and "Linc-Weld" motors. G. O. FORSETH, formerly a sales representative at Detroit, Mich., has been promoted to the position of district sales representative, with headquarters at Minneapolis, Minn.

ROBERT L. DAUGHERTY, professor of mechanical and hydraulic engineering at the California Institute of Technology, Pasadena, Calif., and a vice-president of the American Society of Mechanical Engineers, has been elected chief executive of the city of Pasadena. The chief executive is not known by the title "mayor," in Pasadena, but instead as Chairman of the Board of City Directors.

LEWIS TAYLOR ROBINSON, engineer in charge of the general engineering laboratory of the General Electric Co., Schenectady, N. Y., was the recipient of the honorary degree of doctor of science at the 133rd annual commencement exercises of Union College, Schenectady, in June. Mr. Robinson is a fellow of the American Institute of Electrical Engineers, and twice held the office of vice-president of that society, as well as the chairmanship of the standards committee, in 1919-1920.

A. W. GAEBELEIN, who for eight years has been the Eastern representative of the Machinery Division of the New Britain Machine Co., will devote his entire time in the future to selling the screw products and shop furniture made by the New Britain Machine Co., who recently turned over the machinery end of its business to the New Britain-Gridley Machine Co., New Britain, Conn. The sales of the New Britain-Gridley Machine Co., formerly handled by Mr. Gaebelein, will now be handled directly by the New Britain office.

FRANK R. DEAKINS has been appointed sales manager of the radio department of the General Electric Co., Schenectady, N. Y. Mr. Deakins entered the testing department of the General Electric Co., at Schenectady, in 1915. In 1918, when assigned to radio work with the company, he was detailed to Washington as contact man with the bureau of aeronautics and the army and navy departments on aircraft radio. The present radio department was organized in 1921, and Mr. Deakins went into the department, being made assistant in charge of sales, in 1926.

ARTHUR W. GRAY has joined the staff of the Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa., as an associate director of research. He will be engaged mainly in the development of scientific and industrial instruments. During the last thirteen years he has served as director of physical research of the L. D. Caulk Co., and vice-president and director of research of Dielectric Products, Inc. Mr. Gray established the thermal expansion laboratory of the Bureau of Standards, and originated important methods and apparatus that are still in use there.

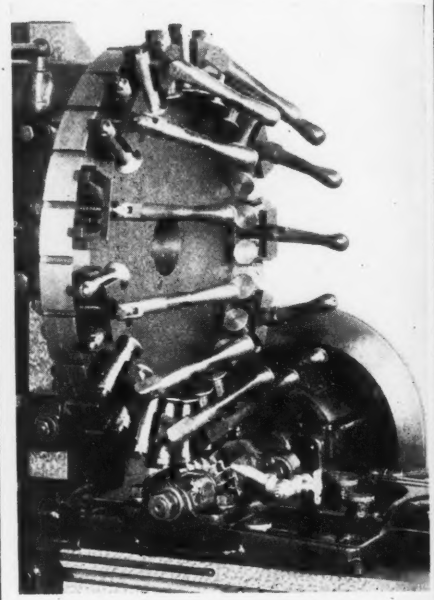
O. H. BROXTERMAN has established himself in business as a manufacturers' representative in Cincinnati, Ohio, covering southern Ohio, southern Indiana, and northern Kentucky. Mr. Broxterman is in a position to take a few more agencies for lines of equipment and supplies sold to machinery manufacturers, including metal-cutting tools, tool and die work, castings, forgings, metal stampings, steel office and shop equipment, emery wheels, etc. Mr. Broxterman was formerly president of the John Steptoe Co. of Cincinnati, and is well known in the machinery trade in Cincinnati and vicinity.

WILLIAM ALTHOFF, who for the last two and one-half years has represented the Studebaker Corporation in Brazil, Mexico, and the West Indies, and who has during the past year been managing director of the company's subsidiary in Brazil, has completed his special work for the Studebaker Corporation and has just returned to the United States. Mr. Althoff has

GEARS · SPROCKETS ·

the modern features of Brown & Sharpe Automatic Gear

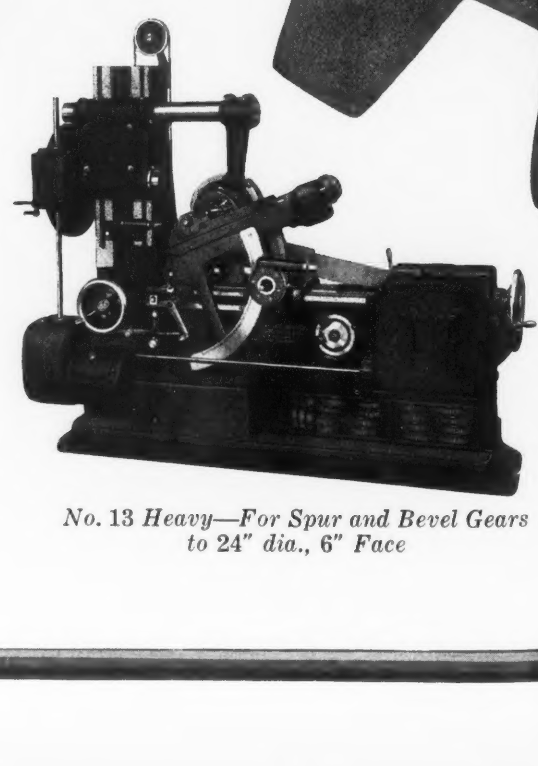
No. 4—For Spur Gears to 48" dia., 10" Face



The complete set up, mounted on a No. 3 machine, was designed by our engineers. The operator needs only to load and unload the fixture in this operation. There may be attractive production possibilities for similar equipment on your work.

No. 6—For Spur Gears to 76" dia., 13" Face

Manufacturers who require a steady production of spur or spiral gears in large quantities should know about the Brown & Sharpe Gear Hobbing Machines. A booklet describing them will be sent upon request.



No. 13 Heavy—For Spur and Bevel Gears to 24" dia., 6" Face

CLUTCHES • SPLINED SHAFTS

Cutting Machines keep costs low on these and many other parts

THERE are machines in the complete Brown & Sharpe line of Automatic Gear Cutting Machines for cutting a large variety of sprockets, splined shafts, and clutches and for milling a large number of parts requiring accurate indexing. Accurately cut gears are only one of the products of these machines.

Nos. 13 and 13 Heavy are particularly fitted for cutting a variety of clutches and sprockets, for cutting taper keyways, for milling the teeth of special cutting tools and for innumerable milling jobs, where automatic indexing is a desirable feature. With special equipment the adaptability of the machines is surprisingly extensive.

Our representatives are always ready to go over your requirements with you. If you have a special job, take the matter up with our Gear Cutting Machine Engineers. They are ready to give you the benefit of their experience in planning production set-ups. Write today.

BROWN & SHARPE
AUTOMATIC
GEAR CUTTING
MACHINES

Nos. 3, 4, 5 *and* 6
for Spur Gears

Nos. 13 *and* 13 Heavy
for Spur and Bevel Gears

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

made no definite plans for the immediate future, but is open for negotiations leading to engagement in the export business, especially in the machinery or automotive field. Mr. Althoff has had twenty years' experience in foreign trade promotion in these fields, and has spent twelve years abroad in work of this kind. He may be reached by addressing him at R. F. D. 179 B, Babylon, Long Island.

A. M. Mueller, associated with Joseph T. Ryerson & Son, Inc., Chicago, Ill., for the last thirty years in the accounting and sales departments, has been made assistant secretary and a member of the board of directors. Mr. Mueller was manager of the St. Louis plant from 1914 to 1917 and later general manager of sales. H. B. Ressler succeeds Mr. Mueller as general manager of sales. Robert C. Ross has been advanced from general traffic manager to the position of assistant to the president in charge of plant operations. William H. Bryant, formerly assistant manager of sales in charge of the Chicago Country territory, becomes Chicago sales manager. Guy H. Rumpf, formerly manager of plant operations, has been made manager of the St. Louis plant. Harry W. Treleaven has been elected assistant treasurer and will continue to be responsible for the office management.

Willard A. Johnson has been appointed manager of the eastern offices of the National Acme Co., 117 Liberty St., New York City, to succeed Harry T. Latto, who resigned on June 16. Mr. Johnson has had many years of sales experience with the National Acme Co., having been at one time connected with the eastern offices and later representing the company in the Ohio territory. The territory now under Mr. Johnson's supervision includes New England, eastern New York and Pennsylvania, New Jersey, Delaware, Maryland, the District of Columbia, and Virginia. His offices are the eastern headquarters for sales and service on Gridley and Acme automatic screw machines and automatic chucking machines which are built at the Windsor, Vt., plant of the company; and for Namco opening threading dies and collapsing taps, "Positive" industrial centrifuges, standard and special screw machine products, and contract manufacturing projects from the Coit plant of the company at Cleveland, O.

C. J. Steuber, district sales manager at Milwaukee for the Carborundum Co., Niagara Falls, N. Y., has been appointed district sales manager at Detroit. His headquarters will be in the new Carborundum Building, 2759 E. Grand Boulevard, Detroit. Mr. Steuber succeeds Anthony Dobson, who is retiring from active business. H. E. Kerwin has been appointed district sales manager at Milwaukee to succeed Mr. Steuber. Robert Rainnie will take over Mr. Kerwin's old territory in the Chicago district. George Harden has been appointed sales manager for Germany. Mr. Harden will make his headquarters at the Deutsche Carborundum Works, Dusseldorf, Germany. Mr. Harden's old territory in and about Flint, Saginaw, and Bay City, Mich., will be taken over by J. C. Gallen, who was previously located in the Lansing and Ann Arbor districts, with headquarters at Detroit. H. S. Monroe will succeed Mr. Gallen in that territory. Mr. Monroe previously represented the company in Detroit, and will be succeeded there by Philip R. Dumas.

* * *

GENERAL ELECTRIC ESTABLISHES EDISON FELLOWSHIP

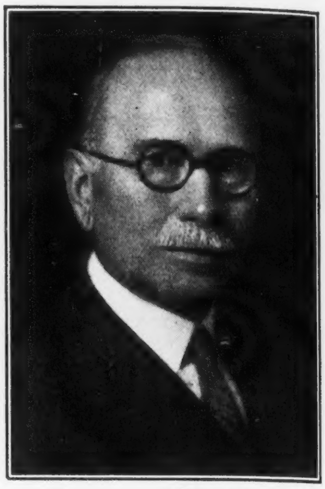
In honor of Thomas A. Edison and in commemoration of the fiftieth anniversary of his incandescent lamp, an Edison Fellowship for Research in the General Electric research laboratory at Schenectady, N. Y., has been established. Its object is to help determine the fitness of the recipient for industrial or scientific research by arranging for a year's research in that laboratory. The opportunity will be given to the selected candidate who has adequate training and who has done sufficient original work to have indicated an aptitude for research. The year's fellowship carries a grant of $3000. The selection from the applicants will be made by the National Research Council with the advice of the director of research of the General Electric Co.

* * *

At a cost of but $400,000, metals having a market value of $3,700,000 as scrap were reclaimed in 1928, by the salvage department of one of the largest industrial plants in the United States.

OBITUARIES

HENRY W. WENDT



© Blank-Stoller, Inc.

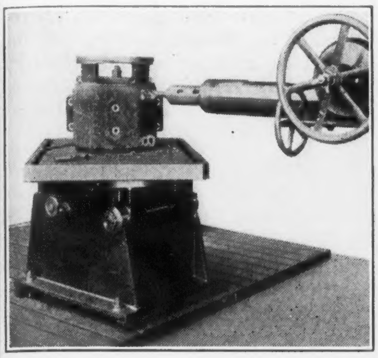
Henry W. Wendt, president of the Buffalo Forge Co., Buffalo, N. Y., died June 12, from pneumonia at the age of sixty-seven years. When he was only sixteen years old, Mr. Wendt became associated with his brother, the late William F. Wendt, in founding the Buffalo Forge Co. Subsequently, he was made works manager and vice-president of the company, and in 1916, became president. He was active during the greater part of his life in improving the art of heating and ventilating and general air conditioning. He was a member of the American Society of Heating and Ventilating Engineers and the American Society of Mechanical Engineers.

Willis H. Diefendorf, president and treasurer of the Diefendorf Gear Corporation, Inc., Syracuse, N. Y., died May 25 at his home in Syracuse at the age of fifty-nine years. Mr. Diefendorf was associated, for nearly thirty years, with the late Thomas W. Meachem in the New Process Rawhide Co. of Syracuse, and remained with the company when it was taken over by the John N. Willys interests and the name changed to the New Process Gear Corporation. In 1920 he left this company and organized the Diefendorf Gear Corporation, which at first occupied space in the Rogers & Hilton Building on Pearl St. In 1923 a plant was bought on West Belden Ave., and in 1924 the property and good will of the Meachem Gear Corporation was acquired by purchase.

Mr. Diefendorf was active in the American Gear Manufacturers' Association and served twice on the executive board of that organization. His ability and friendly personality made him respected and liked by all with whom he came in contact. He is survived by his wife, Mary A. Diefendorf; a son Donald W. Diefendorf, a student at the Massachusetts Institute of Technology; and by his mother, Ella C. Diefendorf.

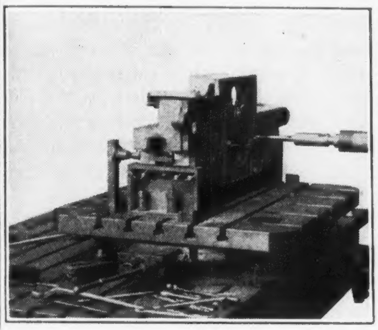
Murray Shipley, co-founder with William Lodge, in 1892, of the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, died at his home in Cincinnati May 30, following a brief illness. Mr. Shipley was born in Cincinnati in 1865, and graduated from the Sheffield Scientific School of Yale University in 1885. Previous to founding the Lodge & Shipley Machine Tool Co., from which he retired in 1917, he was engaged in a mercantile business for a short time, and for two years was connected with the Manley & Copper Co. of Philadelphia, doing structural iron work. Later he was connected with Sechler & Co., manufacturer of vehicles. He has served as president of the National Metal Trades Association, and also as president of the Cincinnati branch of that association. For many years he was active in the machine tool industry, and was one of the founders of the National Machine Tool Builders' Association.

D. T. Homan, vice-president of the Bridgeport Safety Emery Wheel Co., 1283 W. Broad St., Bridgeport, Conn., recently passed away at the age of eighty-three years. Mr. Homan was born in 1846 near Yaphank, Long Island. He graduated from the Eastman College at Poughkeepsie, N. Y., and was later engaged in selling activities. In 1881 he became associated with E. R. Hyde, now president of the Bridgeport Safety Emery Wheel Co. They formed the Springfield Glue & Emery Co. of Springfield, Mass., which company later removed to Bridgeport, Conn. When the Bridgeport Safety Emery Wheel Co., Inc., was formed, Mr. Homan continued, with Mr. Hyde, to direct the activities of the company, Mr Homan taking care of the selling of equipment throughout the country. He was quite active until a few years ago and was well known to purchasers of grinding machinery, especially in the steel mill field.



Drilling, Spot Facing and Back Facing Motor Frame on No. 12 Horizontal Drilling and Boring Machine. Work clamped on Universal Tilting and Revolving Table. Material—Cast Steel—Weight—468 lbs.

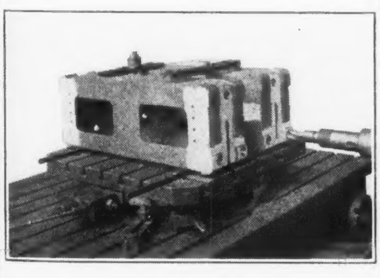
4 Holes 1-5/32" drilled thru 1¼" metal and back faced. 8 Holes 49/64" drilled thru ½" metal and back faced. 4 Holes ⅞" drilled thru 1⅝" metal and back faced.



Drilling a cast iron trolley side, with jig. Mounted on a 4' revolving table. Weight of casting 900 lbs.; of jig 205 lbs.

Thirteen ¾" bolt holes drilled and spot faced thru 1½" material.

Two 1½" holes drilled and reamed thru 3¼" material. Number 11 Ryerson Horizontal Drilling and Boring Machine used.



Grey Iron Casting 12" wide, 18" high, 4' long, mounted on a 48" revolving table and drilled from four positions with the one set-up.

Four 1¾" holes drilled thru 1" material. Two 1¾" holes drilled and reamed thru ½" material. Eight 11/16" holes drilled thru ⅝" material. Fixed column type Ryerson Horizontal Drill used.

A Ryerson Horizontal Drilling and Boring Machine in Action

The Job—720, 1-1/16 inch holes 2 inches deep —Completed in one day

Quite an unusual job, but one which shows how the Ryerson Horizontal can be adapted to almost any work that comes along.

They can handle the large bulky pieces, the "hard-to-get-at" parts and they can also profitably handle small pieces on a production schedule—in fact, anything in the shop.

On ordinary work, a big saving is possible on set-up time. With a plain rotary table four sides of a job can be drilled from the one setting. With the revolving and tilting table five sides can be worked. The unusual vertical travel of the spindle, in combination with the horizontal travel, permits working over an extremely large area without special blocking or turning of the job.

Let us send you complete information on the Ryerson Horizontal Drills.

Write for Bulletin M-4051.

JOSEPH T. RYERSON & SON INC.
ESTABLISHED 1842

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Houston, Rockford, Kansas City, Tulsa, Los Angeles, San Francisco, Denver, Minneapolis, Duluth

Drill it Horizontally

TRADE NOTES

RANE TOOL CO., INC., has moved from 59 Hopkins Ave. to larger quarters at 17 Ross St., Jamestown, N. Y.

CENTURY ELECTRIC CO., 1806 Pine St., St. Louis, Mo., has purchased ROTH BROTHERS & CO., Chicago, Ill., manufacturers of motors and generators.

BROWN INSTRUMENT CO., Philadelphia, Pa., has moved its Boston office from 161 Devonshire St., to larger quarters at 1107 Public Service Building, 89 Broad St., Boston.

CHICAGO STEEL & WIRE CO., and its associate, FUSION WELDING CORPORATION, both at 103rd St. and Torrence Ave., Chicago, Ill., announce plans for the construction of new general offices, adding over 8000 square feet to the space they now occupy.

WILLARD TOOL CO., INC., 54 Brothwell St., Bridgeport, Conn., has acquired the patents and the manufacturing and selling rights for the Willard spring tool-holders, which for the last four years have been manufactured by the Moore Special Tool Co.

GROETCHEN TOOL & MFG. CO., 126 N. Union Ave., Chicago, Ill., manufacturer of copper-head laps, has taken over the EDWARD E. MCMORRAN CO. of Chicago. The plant has been greatly enlarged, and the company is now in a position to make prompt delivery of its products.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that the railway engineering department has been reorganized and will be known in the future as the transportation engineering department, with H. L. Andrews as engineer in charge and W. B. Potter as consulting engineer.

LINDE AIR PRODUCTS CO., 205 E. 42nd St., New York City, has established a new oxygen producing plant at 150 Stockton St., Jacksonville, Fla. E. H. Blount is superintendent of the Jacksonville plant, and J. Erskine is district superintendent, with headquarters at the Birmingham Linde plant.

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis, Mo., has moved its Buffalo service station and branch sales office to a new building at 1796 Main St. The Buffalo office handles the entire Wagner line of motors, transformers, fans and Lockheed hydraulic brakes, not only as a branch sales office, but also as a repair shop and service station.

STUEBING COWAN CO., Cincinnati, Ohio, is erecting a modern plant for the manufacture of electric lift trucks, tractors, hand trucks and platforms. The plant will constitute a one-story fireproof building, 160 feet wide by 330 feet long, and a two-story office building. The increased size will provide capacity for two and one-half times the present production.

ETTCO TOOL CO., INC., 590 Johnson Ave., Brooklyn, N. Y., has been formed to handle the Small Tool Division of the Eastern Tube & Tool Co., Inc. The new company will manufacture drill chucks and tapping devices, and the parent company will continue to manufacture electric cables. The address of the two companies will remain the same as heretofore.

WELKER MACHINERY CO., INC., 2720 Union Trust Bldg., Detroit, Mich., has been appointed exclusive agent in the state of Michigan for the Ferracute Machine Co., Bridgeton, N. J., manufacturer of presses. C. W. Ribble, formerly press engineer for the Ferracute Machine Co., has joined the Welker Machinery Co., Inc. as sales engineer, and will have charge of the sale of Ferracute presses.

FAFNIR BEARING CO., New Britain, Conn., announces the establishment of a separate sales division to cooperate with aviation companies in the development of suitable ball bearings for use in airplane construction. The Fafnir Bearing Co. has already had considerable experience in this field, having supplied ball bearings for many aviation engines, including the Hispano-Suiza, LeRhone, and Liberty engines.

GENERAL ENGINEERING WORKS, Chicago, Ill., manufacturers of screw machine products, are now operating in their new plant at 4701 W. Division St. The new plant is a one-story structure having three times the floor area of the old plant. The building has been designed to have an exceptional amount of light, and has been laid out for straight-line production. Additional land has been acquired to allow for expansion.

J. I. CASE THRESHING MACHINE CO., INC., Racine, Wis., has changed the name of the company to the J. I. CASE CO. This change does not affect the corporate identity, but is due to the fact that the previous name was misleading, inasmuch as the company is engaged in making a complete line of agricultural and power farming implements and does not confine its activities to the manufacture of threshing machines.

CENTRAL IRON AND STEEL CO., Harrisburg, Pa., manufacturer of non-skid floor plates, has recently announced changes in the location of its New York and Pittsburgh offices. The New York district office, formerly in the Evening Post Building, is now located in Suite 516 of the new Cunard Building at 25 Broadway. The Pittsburgh district office has been removed from 1606 Commonwealth Building to 1721 Oliver Building.

FOOTE BROS. GEAR & MACHINE CO., 111 N. Canal St., Chicago, Ill., manufacturer of speed reducers, industrial gearing, and tractors, recently established a western sales office at 1855 Industrial St., Los Angeles, Cal. E. D. Bennett will be in charge of the reducer and gear division, and A. N. Henderson of the road machinery division. The company also announces the appointment of S. Howard Eisenberg as district representative for the states of Colorado, Wyoming, and New Mexico, with headquarters at 2812 Ash St., Denver, Colo.

UNION CARBIDE CO., 205 E. 42nd St., New York City, announces that it is erecting a research building at its Niagara Falls plant, 75 feet wide by 250 feet long, with a height of 42 feet 5 inches to the lower chord of the trusses. A full-span 10-ton traveling crane runs the entire length of the building. An interesting feature in connection with this building is that oxy-acetylene welding is being used exclusively for fabricating and erecting the 300 tons of structural steel used in the construction. This is the largest gas-welded structure on record.

BROWN & SHARPE CO., Providence, R. I., is a new corporation organized to take charge of the sale of machinery and tools manufactured by the Brown & Sharpe Mfg. Co., of Providence, in Chicago, Cincinnati, Cleveland, Detroit, and adjoining territories. At the Cincinnati office, G. C. Newell will be machine tool representative. At Cleveland, W. H. Stewart will be machine tool representative, and J. H. Devlin, small tool representative. At Detroit, J. G. Swinburne will be machine tool representative, and R. R. Grimes, small tool representative.

SIMONDS SAW & STEEL CO., Fitchburg, Mass., announces that the president of the company, Alvan T. Simonds, following his custom of the last seven years, has offered $1500 in prizes for the best essays on an economic subject. The subject chosen for 1929 is "The Federal Reserve System and the Control of Credit." One thousand dollars will be awarded for the essay decided by the judges to be the best, and $500 for the next best. The contest closes December 31, 1929. For further information, address Economic Contest Editor, Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

DUREX ABRASIVES CORPORATION, with headquarters at 70 Montgomery St., Jersey City, N. J., and an operating office at 82 Beaver St., New York City, has been formed by nine companies in the abrasives field to conduct their export business. The companies included are the American Glue Co., Armour & Co., Baeder-Adamson Co., H. H. Barton & Sons Co., Behr-Manning Corporation, the Carborundum Co., Minnesota Mining & Mfg. Co., United States Sandpaper Co., and the Wausau Abrasives Co. The new corporation's sales will cover coated abrasive paper and cloth products for every industrial purpose.

FAFNIR BEARING CO., New Britain, Conn., has purchased the RAILWAY MOTORS CORPORATION, De Pere, Wis., for many years maker of the Melcher railway roller journal bearing, which has been in actual service on twenty-five different railroads in the West and Middle West for several years. The Fafnir Bearing Co. will manufacure the Melcher bearing box under the name Fafnir-Melcher roller bearing journal. For the present, the bearing will be manufactured at the Railway Motors Corporation's plant in De Pere, Wis., but will ultimately be made at the main plant of the Fafnir Bearing Co. at New Britain, Conn. L. W. Melcher, designer of the bearing, will continue to have charge of sales and service, with headquarters in Chicago.

COMING EVENTS

JULY 1-4—Summer meeting of the American Society of Mechanical Engineers at Salt Lake City, Utah. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

AUGUST 26-28—Aeronautic meeting of the Society of Automotive Engineers at the Hollenden Hotel, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-11—Fall meeting of the Institute of Metals Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. W. M. Corse, secretary, 810 Eighteenth St., N.W., Washington, D. C.

SEPTEMBER 9-12—Fall meeting of the American Welding Society in Cleveland, Ohio. M. M. Kelly, secretary, 33 W. 39th St., New York City.

SEPTEMBER 9-12—Fall meeting of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. H. Foster Bain, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-13—Annual convention of the American Society for Steel Treating at Cleveland, Ohio. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 9-13—National Metals Congress in Cleveland, Ohio. Simultaneous meetings with the American Welding Society; Institute of Metals Division, American Institute of Mining and Metallurgical Engineers; Iron and Steel Division, American Society of Mechanical Engineers; Iron and Steel Division, American Institute of Mining and Metallurgical Engineers; and American Society for Steel Treating.

SEPTEMBER 9-13—Eleventh National Metal Exposition under the auspices of the American Society for Steel Treating at the Cleveland Public Auditorium, Cleveland, Ohio. For further information, address W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

SEPTEMBER 11-13—Fall meeting of the Iron and Steel Division, American Society of Mechanical Engineers in Cleveland, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 30-OCTOBER 4—Machine Tool Exposition held by the National Machine Tool Builders' Association in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, Provident Bank Building, Cincinnati, Ohio.

SEPTEMBER 30-OCTOBER 4—Machine Tool Congress to be held in Cleveland, Ohio, jointly with the Production Meeting of the Society of Automotive Engineers and the Machine Shop Practice Division Meeting of the American Society of Mechanical Engineers. For further information, address E. F. DuBrul, National Machine Tool Builders' Association, Provident Bank Building, Cincinnati, Ohio.

OCTOBER 2-4—Production meeting of the Society of Automotive Engineers to be held at Hotel Cleveland, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

DECEMBER 2-6—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

NEW CATALOGUES AND CIRCULARS

BLOWERS. P. H. & F. M. Roots Co., Connersville, Ind. Bulletin 22-B1, covering the Roots low-pressure type positive blowers equipped with roller bearings.

STEEL HORSES. Toledo Pressed Steel Co., Toledo, Ohio. (Sales Agents: Montgomery & Co., Inc., 292 Lafayette St., New York City.) Circular treating of Toledo pressed-steel horses.

INDICATING AND RECORDING INSTRUMENTS. Brown Instrument Co., Philadelphia, Pa. Circular illustrating the use of Brown pyrometers on General Electric heat-treating furnaces.

ARC-WELDING EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Circular DMF-5156, illustrating the wide range of uses of electric arc-welding in the maintenance field.

ELECTRIC EQUIPMENT. Roller-Smith Co., 233 Broadway, New York City. Supplement No. 1-A to Bulletin 580, containing capacities and price lists of Roller-Smith enclosed circuit-breakers.

BENCH LATHES. Rivett Lathe & Grinder Corporation, Brighton, Boston, Mass. Bulletin 505-C illustrating and describing Rivett plain precision bench lathes and attachments. Complete specifications are included.

MACHINERY, TOOLS, AND SUPPLIES. Montgomery & Co., Inc., 292 Lafayette St., New York City. Circular containing data on K-O toolmakers' clamps, V-blocks, drill jig angle-plates and drill press vises.

CHARCOAL PIG IRON. Superior Charcoal Iron Co., Grand Rapids, Mich. Booklet treating of Superior charcoal pig iron. Following a brief historical outline, the pamphlet takes up characteristics, uses, grades, and brands.

OIL CIRCUIT BREAKERS. Roller-Smith Co., 233 Broadway, New York City. Bulletin 600, dealing with type O oil switches and circuit breakers made in capacities of from 200 to 2000 amperes and from 2500 to 15,000 volts.

ELECTRIC EQUIPMENT. Lincoln Electric Co., Cleveland, Ohio. Circular entitled "Let's Start Something," illustrating the Lincoln safety push-button for starting electric motors. The circular also illustrates the Lincoln "Linc-Weld" motor.

COMBINED DRILLS AND COUNTERSINKS. National Twist Drill & Tool Co., Detroit, Mich. Circular outlining the advantages of the combined drills and countersinks made by this concern. Tables of dimensions and prices are included.

MATERIAL HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickcliffe, Ohio. Circular illustrating the use of the Cleveland Tramrail system for handling products through the making processes on racks.

FLEXIBLE METAL HOSE. Atlantic Metal Hose Co., Inc., 351 W. 52nd St., New York City. Circular illustrating and describing Atlantic flexible metal hose, which is made in all sizes from 1/8 inch up to and including 10 inches internal diameter. List prices are included.

MILLING MACHINES. Ingersoll Milling Machine Co., Rockford, Ill. Circular illustrating twelve special Ingersoll production milling, boring, and drilling machines, applicable for a wide variety of service. The circular also illustrates the Ingersoll cutter grinder for grinding milling cutters.

HARDNESS TESTING EQUIPMENT. Edward G. Herbert, 149 Barlow Moor Road, West Didsbury, Manchester, England. Circular describing a new differential process for measuring the depth of casehardening by the use of the Herbert pendulum hardness tester and the "Cloudburst" testing machine.

ROLLER BEARINGS. Hyatt Roller Bearing Co., Newark, N. J. Circular entitled "Protecting Quality Products," dealing with the application of Hyatt roller bearings in material handling equipment, power transmission equipment, motor vehicles, railways, operating equipment used in mines, oil fields, etc.

NICKEL STEEL. International Nickel Co., Inc., 67 Wall St., New York City. Pamphlet No. 14 in a series on data and applications of nickel steel, containing the reprint of an article on the manufacture of nickel steel plate, published in the *Transactions* of the American Society of Mechanical Engineers.

TANK HEADS. Commercial Shearing & Stamping Co., Youngstown, Ohio. Circular giving dimensions of flanged and dished heads for tanks, as well as "Obround" heads. Other tank specialties illustrated include man holes, label frames, flange covers, range boiler heads and bottoms, and water heater stampings.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Circulars for loose-leaf catalogue, dealing with air compressor sets, arc-welders, sheath-wire immersion heaters, elevator motors, current-limiting resistors, circuit breakers, switchboard devices, switching equipment, electric relays, and electric recording instruments.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., Nuttall Works, Pittsburgh, Pa. Circular 1838, describing the construction, application, and maintenance of type E flexible couplings, which are especially designed for use with speed reducers. Circular 1831, illustrating and describing helical and herringbone gear units for heavy-duty drives.

MANGANESE STEEL. American Manganese Steel Co., Chicago Heights, Ill. Circular entitled "Add Length of Life and Freedom from Repair to Your Equipment," treating of the use of Amsco manganese steel for parts subjected to shock, wear, and abrasion, as well as the use of Fahralloy for parts subjected to heat and corrosion. Post-card advertising the use of American manganese steel in industrial pumps.

GRINDING WHEELS. Blanchard Machine Co., 64 State St., Cambridge, Mass. Circular illustrating and describing Blanchard grinding wheels, which are made for use on Blanchard surface grinders. The pamphlet contains a table showing recommended wheels for different classes of work, and gives other general information of value in selecting grinding wheels. A number of pictures showing typical work performed on Blanchard machines are included, and the wheel data is given in each case.

GRINDING WHEELS. Dumore Co., 25 Sixteenth St., Racine, Wis. Booklet entitled "Precision Grinding," describing and picturing the story of grinding from the beginning up to the present time. Considerable information of value to those interested in grinding is contained in this booklet. Among the subjects covered are: Selecting proper grinding wheel; grain size and its relation to finish; arc of contact; wheel speeds; work speeds; grinding tapers. The book also contains many illustrations showing grinder installations on a wide variety of work.

ALLOY STEELS. Ludlum Steel Co., Watervliet, N. Y. Catalogue devoted to "Enduro" KA2 steel, an alloy of chromium, nickel, and iron which, when polished, is proof against water, atmospheric attack, dilute solutions and acids. A wide range of applications of this new alloy steel is illustrated. Catalogue treating of "Nitralloy" and the nitriding process. The catalogue gives the analyses of "Nitralloy," physical properties, and operations prior to nitriding. It also describes the equipment for nitriding, the nitriding process, and the operations after nitriding, as well as the properties of the nitrided case.

LUBRICATING OILS AND DEVICES. E. F. Houghton & Co., Third, American, and Somerset Sts., Philadelphia, Pa. Booklet on industrial plant lubrication, the first of a series prepared by the Houghton research staff. The pamphlet discusses the lubrication theory, objections to the use of mineral lubricating oils, objections to the use of greases, Houghton's absorbed oils, lubrication of bearings, the fallacy of specifications, effect of temperature on lubricants, relation of correct lubrication to plant efficiency, lubricating devices, application of Houghton's absorbed oils, lubricants for the power house, lubrication of air compressors, etc.

CALENDARS RECEIVED

COOPER HEWITT ELECTRIC CO., Hoboken, N. J. Calendar for June, 1929 to May, 1930, showing on each sheet the calendar for three months, as well as illustrations of Cooper-Hewitt illumination in a wide variety of plants.

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